SCIENTIFIC AMERICAN

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ELECTRIC MOTOR ON THE NEW YORK ELEVATED RAILROAD.

Preliminary trials of a Daft electric motor, the Ben Franklin, have been in progress for some time past on a portion of the Ninth Avenue Elevated Railroad of this city, extending from 14th to 52d Streets. The dimensions of the principal parts of this motor are as follows:

Driving wheels, 48 in. diameter; trail wheels, 36 in. diameter; length over all, 14 ft. 6 in.; spread of wheels, 5 ft. 6 in.; diameter of armature, 25 in.; weight of armature, complete with shaft, 850 lb. Total weight of motor, 8¾ tons. Ratio of armature revolutions to drivers, 1 : 5·5. Ratio of peripheral speeds of armature and drivers, 1 : 2·8+. The reversing arrangements consist of four brushes attached with compound levers, and so connected that the direction of rotation must necessarily be that best suited to the proper contact and wear of the brushes. There is also abundant provision made for varying the points of contact in proportion to the load, speed, etc. The regulating switch consists of a sliding plate having metallic contacts arranged on its surface in such a manner that a number of spring contacts effect changes in the internal resistance of the machine, so as to regulate the speed without the use of idle resistances, none of which are employed; the highest economy is therefore obtained with light as with heavy loads. The electric brakes are of the pendulum type, which were first used on the Mt. McGregor motor in 1883, and are connected with a switch conveniently arranged to vary their power by variation of internal resistances. The mechanical brake consists of a compound lever attachment operated by a screw shaft through a thoggle mounted nut. Contact with the third rail, placed between the main rails, is effected by means of a phosphor-bronze wheel attached to a movable framework, which can be raised and lowered as occasion requires, by means of the lever shown in the side elevation, Fig. 3.

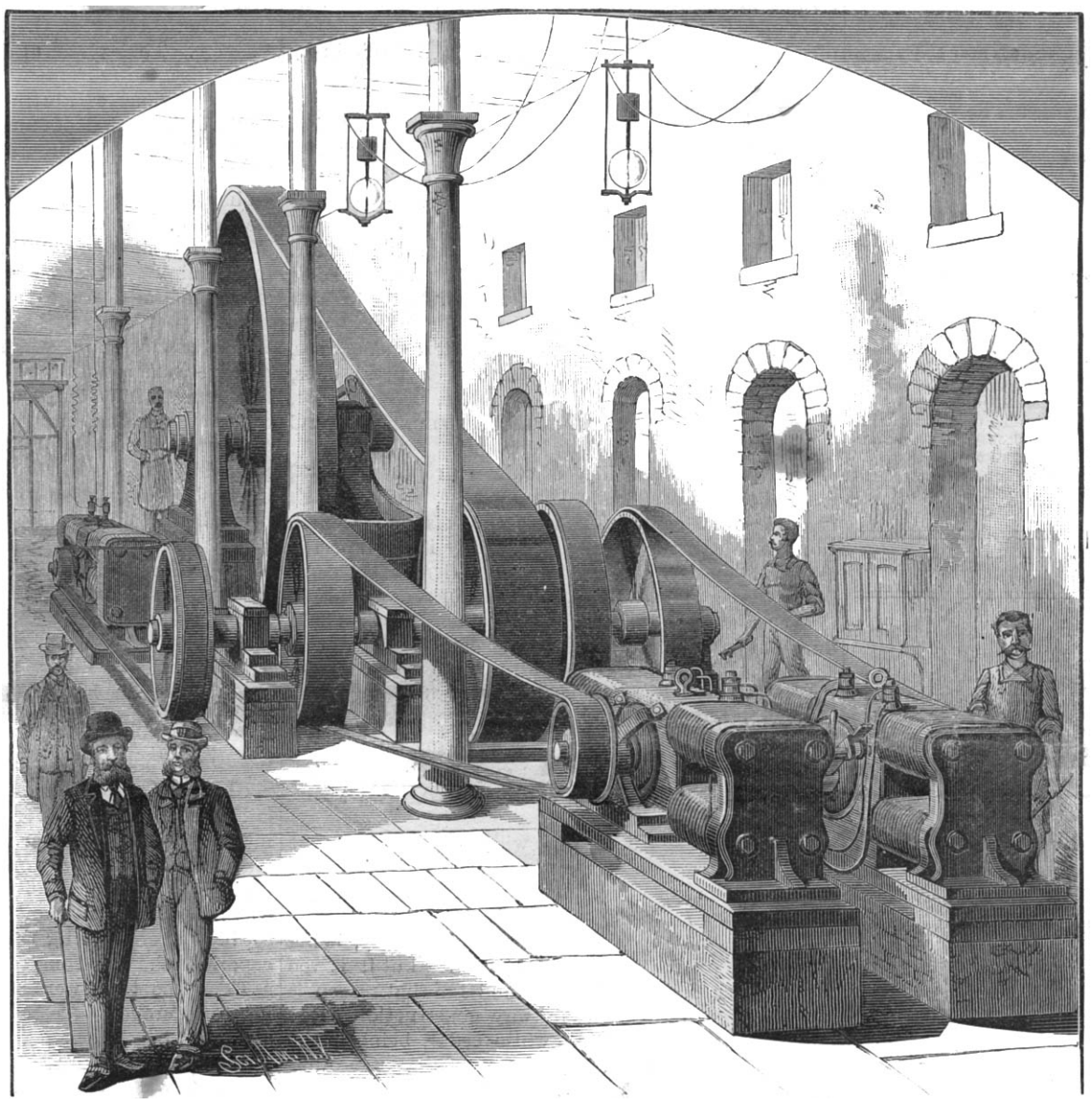


Fig. 1.—DYNAMO STATION OF THE DAFT ELECTRIC MOTOR.

Upon each end of the armature shaft is a small wheel, formed with corrugations on its face which fit in corresponding corrugations on the face of a larger wheel mounted at each end of the driving wheel axle. As will be seen by reference to the drawings, Figs. 3 and 4, the electro-dynamic machine is pivoted at one end in resilient bearings and attached to a vertical screw shaft at the other end, so as to enable the operator to vary the frictional contact between the friction gearing at will, and also affording an easy and convenient means for raising the whole machine to effect a change of armatures.

In order to avoid damage to the gearing and other parts of the electro-dynamic machine from shock, the whole machine is maintained in about equal resilience by means of alternating laminæ of iron and India rubber placed over the bearings of the drivers in lieu of the ordinary springs, and again in the pedestals at either end of

(*Continued on page* 326.)

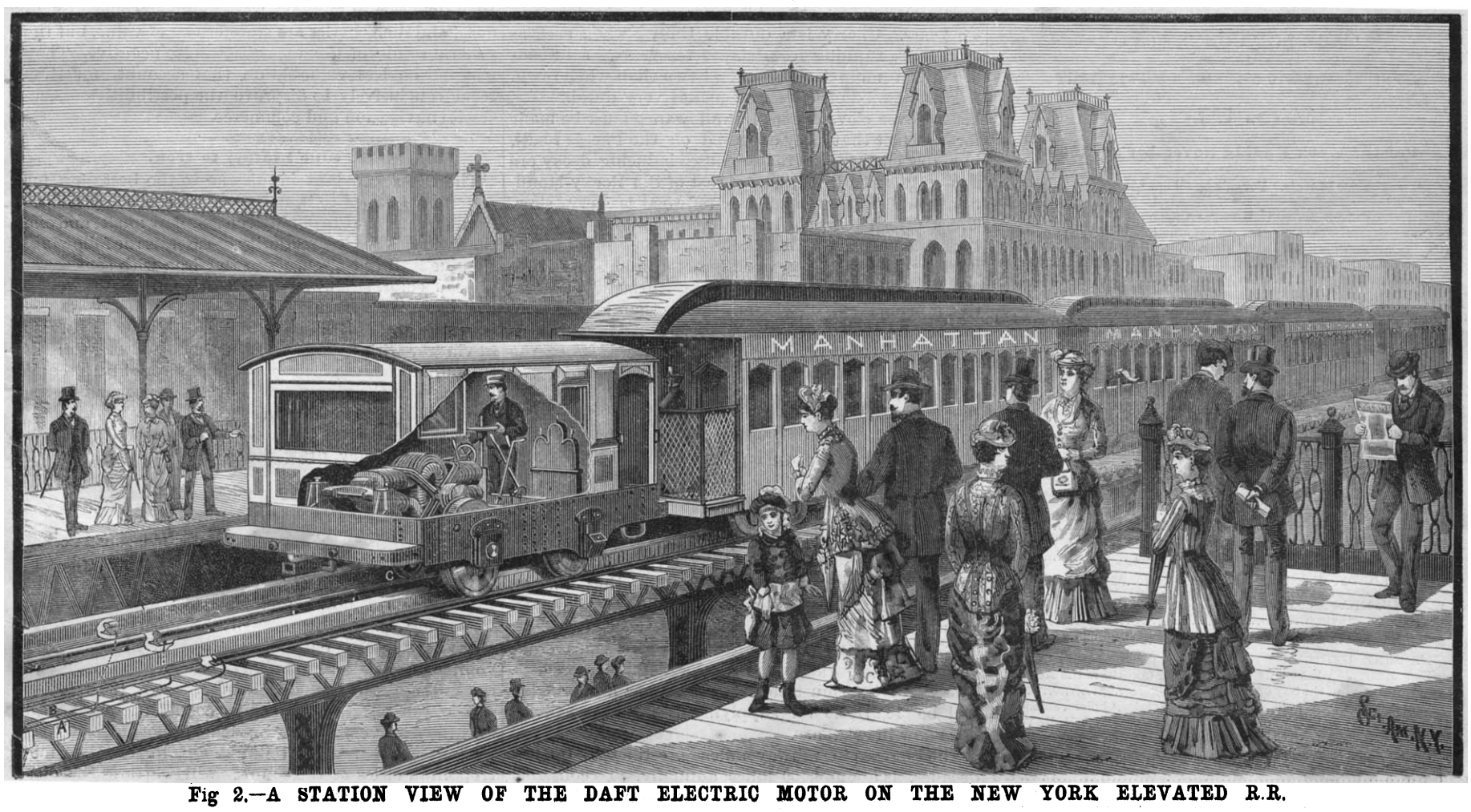
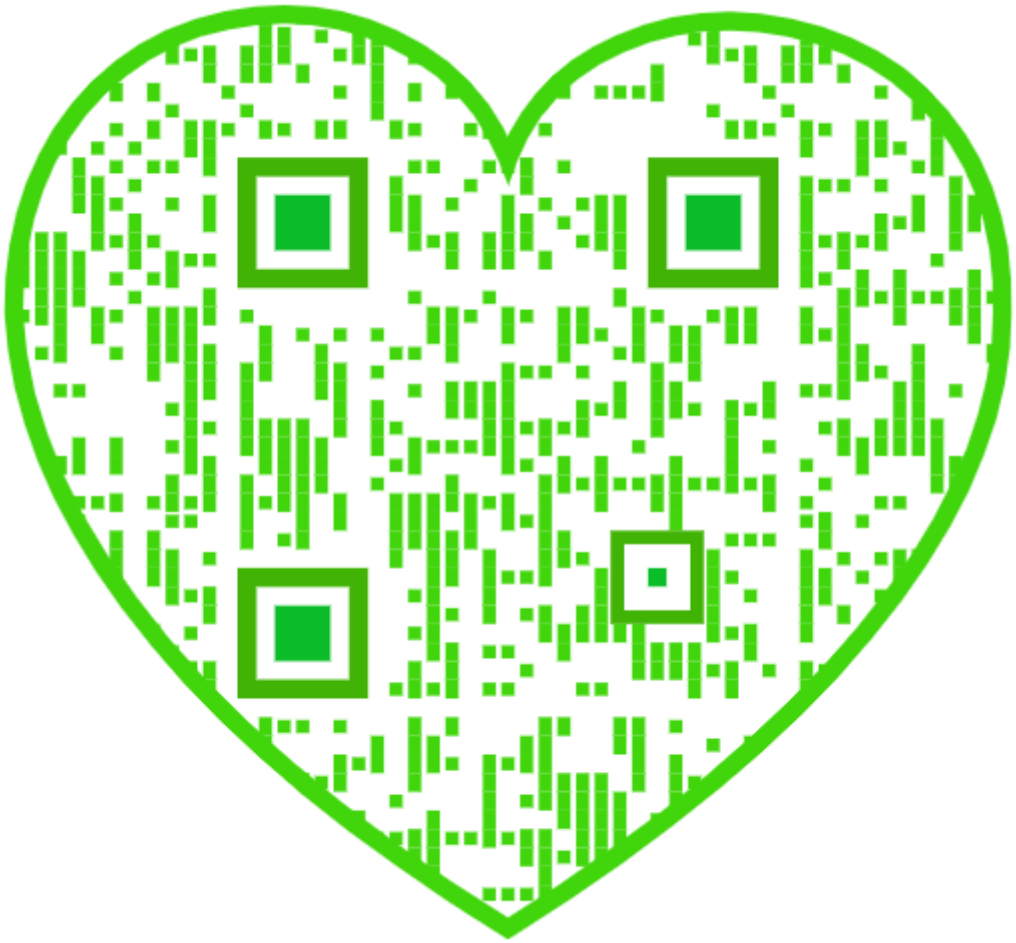


Fig 2.—A STATION VIEW OF THE DAFT ELECTRIC MOTOR ON THE NEW YORK ELEVATED R.R.



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NEW YORK, SATURDAY, NOVEMBER 21, 1885.

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THE NATIONAL ACADEMY OF SCIENCES.

The National Academy of Sciences met at Albany, N. Y., on Nov. 10, and enjoyed a large and distinguished attendance. During the four days of the session a large number of papers were presented; many of them were of more than ordinary interest. Prof. Young gave a *resume* of the history of that erratic star in Andromeda, and quoted Monck's hypothesis accounting for its luminosity on the ground that it may be a dark star passing through the nebula. Prof. Pickering's paper on "Stellar Photography" attracted marked attention. After pointing out the great progress which has been made in this department of late years, he cited a recent victory in gaining the impression of stars so distant or so minute as to be beyond the discovery of the most powerful telescope yet constructed. Major Powell's description of the stone ruins on the Colorado and Rio Grande pointed to the conclusion that the arid regions now so characteristic of the interior of the continent were once fertile and well watered. His paper was full of interest. Prof. Graham Bell made a preliminary report on hereditary deafness, having made a careful study of three out of the six branches of the Lovejoy family, in which there are numerous deaf mutes. Other papers by Prof. Hall, Prof. Newberry, and other well known members made the session one of much interest.

Durability of Cross Tie Timber.

In an investigation of this subject made by Mr. F. B. Hough for the Department of Agriculture, some interesting facts are brought out. The relative importance of the various kinds of timber for railway purposes are reported in the following order: Oaks, pines, chestnut, hemlock, cedars, tamarack, cypress, elms, ash, cherry, black walnut, firs, spruce, beech, locust, redwood, maple, butternut, coffeenut, mulberry, and mesquite.

The average durability of oak, as reported in 32 cases, is 7·4 years, while the average price of each cross tie is 41·2 cents. The kind of oak is not specified. For white oak the average durability in 152 reported cases is 7·3 years, and the average price in 173 cases is 40·6 cents. The average duration of a post oak tie is 7 years, and the average price 33 cents. For burr oak, durability, 7·4 years; price, 37·3 cents. Rock oak showed an average durability in 18 cases of 7 years; price, 42 cents. In the case of red oak 5 years is the average durability, with an average cost of 27 cents. Chestnut oak is more durable, showing an average lifetime as a tie of 7·1 years; cost, 28 cents per tie. Black oak shows an average durability of 4½ years; average price, 43 cents.

Long leaf or southern pine will last on an average 6½ years; average cost per tie, 37 cents. White pine has about the same durability with less cost, the latter showing an average of 31½ cents per tie.

Cedar shows the greatest average durability, being 11·8 years, with average cost of 34 cents, but it is too soft to bear heavy freightage, and for that reason is not much employed in railway construction. Red cedar is more durable than white cedar, being in the proportion of 11 to 7. Cypress shows greater durability than white oak, the former showing an average of 8·7 years. White ash and black ash rot very quickly, the former in 4·3 years, and the latter in 3·8 years. Cherry is a durable timber when used as cross ties, running from six to ten years. All woods are much more lasting when hewn than when sawn.

The redwood of California makes very durable ties, lasting over eleven years, but allowance must be made for the fact that they are used on the Pacific roads, in a dry climate, where the causes inducing decay are not so great as in the States east of the Rocky Mountains. The growth of the redwood is very slow. Trees fifteen years old have a diameter of only ten or twelve inches, and will make about three ties. When younger than this, the wood in not durable. The redwood of the Santa Cruz Mountains furnishes the best ties, it being much heavier and denser than when grown further north. The average cost of redwood ties is 40 cents. The total length of railway track in the United States is approximated at 150,000 miles. Assuming that the average durability of ties is seven years, and the distance apart is three feet, there will be 2,640 to the mile, which is rather under than over the actual number employed, making the total number in use 396,000,000. Estimating one-seventh to be replaced every year, the annual demand to keep up the present railways will reach 56,571,428. Supposing that an acre will supply 100 ties, which is a liberal estimate, it will require 565,714 acres annually to furnish the ties required by the existing lines of railways. For each mile of railway there will be an annual demand for 377 ties, requiring the cutting off of 3·77 miles. It will require thirty years on an average for trees to grow large enough for making cross ties. The acres that must be kept in timber and growing will be 16,971,420 for supplying ties to the railway lines now in existence.

The increase in railway mileage, estimated by two decades, is about 4,150 miles annually. To construct the railways that will probably be built in the next ten years, 109,560,000 ties will be demanded, the product of 1,095,600 acres of woodland. Allowing thirty years as the period of growth for ties, this would add 3,286,801 acres to the timber reserve for railways alone, making a total of 18,996,570 acres as the needful reserve. Evidently this question is one demanding reach of statesmanship and a careful preservation of our present timber supply. The time is not far distant when one of the largest items in the construction expenses of our railways will be the one for cross ties.

Return of the Alert from Hudson's Bay.

The Arctic steamer Alert, whose name is so familiar to everybody from her connection with the Greely Relief Expedition, returned to Halfax on October 18, after an eventful cruise in Hudson's Bay. Some of our readers will perhaps remember that in the summer of 1884, a staff of observers was sent out by the Canadian Government to establish stations at various points on Hudson's Bay, and to decide if possible upon the practicability of the much talked of Northwest Passage. Their observations were to include temperature, tides, ice movements, and mineral resources, besides questions of abstract science, and were to extend over a period of one year. They were to have been relieved this summer, but the Alert was several weeks late in keeping her engagement. She started on her cruise in good season, but was caught in the ice, and drifted hopelessly about for over three weeks. When free, she was obliged to put back to St. Johns for repairs. Her commander, Lieut. Gordon, ascribed this misfortune to the bad weather, the season this year being at least a month later than usual. The second attempt was more successful. The main passage was comparatively free from ice, though the Alert encountered large floes from having to visit the different stations. In Hudson's Bay no ice was encountered, but a series of very heavy gales, accompanied by sleet and snow, followed each other at short intervals. Stupart's Bay Station was found to have been abandoned the day before the arrival of the relief party. Stupart and his companions, fearing the approach of a second winter, had started out in an open whaling boat for Chizno Bay, 300 miles distant. After much suffering, they were finally rescued by the steamer Labrador. All of the other explorers, except Andrew Inglis, who had died of scurvy, were brought home safely by the Alert. The expedition cannot be said to have accomplished very much. The ice movements were shown to be so variable that every voyage must be regarded as an experiment. The possible navigation is limited to three or four months, and even then is hazardous in the extreme. The experience of the Alert may be said to have confirmed the worst that has been said against the project. The temperature was less severe than anticipated, an average of only 30° below zero during the cold weather having been experienced. The rough frame cabins were easily kept at 60°. The tides were sometimes excessive, amounting to differences of 32 and 35 feet. The currents were also very pronounced. Dr. Bell, of the Geological Survey, who accompanied Lieut. Gordon, found evidences of considerable mineral wealth, and expresses himself in favor of continuing the experiments. Rich fur-bearing animals were found in some abundance, and the fisheries are stated to be of value, but the general results of the expedition were negative. They may not be less valuable on that account, for they seem conclusively to disprove the possibilities of successful navigation and commerce.

To Glue Leather to Iron.

There is a constant inquiry as to the best plan for fastening leather to iron, and there are many recipes for doing it. But probably the simplest mode, and one that will answer in a majority of cases, is the following: To glue leather to iron, paint the iron with some kind of lead color, say white lead and lamp black. When dry, cover with a cement made as follows: Take the best glue, soak it in cold water till soft, then dissolve it in vinegar with a moderate heat, then add one-third of the bulk of white pine turpentine, thoroughly mix, and by means of the vinegar make it of the proper consistency to be spread with a brush, and apply it while hot; draw the leather on quickly, and press it tightly in place. If a pulley, draw the leather around tightly, lap, and clamp.

Natural Gas for Eastern Cities.

An enterprise which contemplates the construction of the proper conduits for conveying natural gas from Western Pennsylvania to both New York and Philadelphia is now under consideration. The pipes for so long a line will necessarily be much larger than those now in use, both on account of the increased volume of gas desired to be transferred through one conduit, and the large frictional losses in the velocity due to the distance. The first cost of the plant will naturally be very large, but the importance of possessing such a fuel and illuminant in the two metropolitan cities of the country will warrant the outlay, and once in operation, the cost of maintenance will be but nominal.

The Soaring Birds.

In a short paper under this title put forward by Mr. I. Lancaster, of Chicago, an attempt is made to explain the equilibrium of soaring birds by the mechanical action of currents of air on inclined planes. A horizontal air current, meeting the inclined plane of the bird's wings, is resolved into two forces, one in the direction of the inclined plane and one at right angles to it, so that the creature when poised in mid-air may be said to be continually sliding down an upward current of air. In test of this theory, practical observations were made on the southwestern coast of Florida, where soaring birds are somewhat abundant. On one occasion, a score of light gray pelicans rose in the air and floated in the vicinity for several hours, offering an excellent opportunity for studying their motions. One of the birds had at first some difficulty in obtaining a position, but in the end maintained a steadier poise than any of the others. The flock was about thirty feet distant from the observer, and their wings were apparently perfectly rigid. Finally, one of the birds rose steadily in the air at the rate of about ten feet per second until a mile or more above the sea. A study of the conditions under which this equilibrium and ascent were accomplished leads Mr. Lancaster to give the following quantitative analysis of the forces involved:

Taking for instance a bird of eight pounds weight and a breeze blowing in a horizontal plane at the rate of twenty miles an hour, or about thirty feet a second, the direction of the wind will be changed by the inclination of the lower surface of the wings from horizontal to vertical. There will then be eight pounds falling thirty feet per second, or 240 foot-pounds as the motive power. This is supposed to raise the bird ten feet per second against gravity, which will require a force of eighty foot-pounds. Subtracting this amount from the available energy, the 160 foot-pounds left over are to hold the bird against the wind and compensate for lost work. The problem is one of considerable interest, and particularly if its solution, as seems not unlikely, has any bearing upon the question of aerial navigation. The explanation offered is not satisfactory in several particulars, for the assumption that the entire force of an air current is changed by the bird's surface from horizontal to vertical is not warranted, nor does it account for the motion or poise of soaring birds during a period of calm.

Ostrich Farming in California.

During the Transvaal war, the South African ostrich ranch of Dr. Sketchly was devastated by Boers and Zulus, and it is to this circumstance that the now flourishing ostrich ranch near the town of Norwalk, 21 miles south of Los Angeles, owes its origin. Dr. Sketchly concluded that southern California might afford both the climatic and law-abiding qualifications necessary for successful ostrich farming, and something less than three years ago started his enterprise with twenty-two birds, ten males and twelve hens, brought from the Cape. He has raised forty birds on the new ranch, and has succeeded so well that he feels the industry to be well established.

The novelty of the culture brought so many visitors to the ranch that it was found necessary to charge an admittance feet of fifty cents to prevent too great an interruption. All dogs are rigorously excluded, or, if they find entrance, are speedily put out of the way; for even rotten ostrich eggs are valued at $2, and good ones from $50 to $100 apiece, so that egg sucking is very undesirable. Of the two hundred acres included in the ranch, eighty are sown to alfalfa, thirty are in corn, and the remainder devoted to the pens, corrals, and other purposes. The sixteen months old birds are kept by themselves in a separate corral. They are six feet high, quite timid, and regain an abundant and glossy plumage three months after being plucked. A little over a year old these chicks produced feathers two feet long—a record unequaled even in Africa. It requires seven months for the new plumage fully to mature.

The adult birds are kept in pairs. The hens are of a speckled brownish color, while the males are a glossy black, with one row of magnificent white feathers on wing and tail. When wild, the birds depend upon their speed for protection, as they can readily outrun the fastest racehorse; and when cornered, their silly habit of hiding the head to escape danger is well known, and furnishes the object of many a disparaging comparison. In captivity, however, they are ferocious and dangerous. Their mode of attack is invariably by kicking, and the immense claw at the end of one of the two toes is an ugly weapon at the command of such muscular legs. When enraged, they make no attempt to jump over the fences surrounding their quarters, but are able to brush them away with little effort. The wings seem to be used only as a steering apparatus, to carry the bird around corners and sharp curves.

In rearing the young, the ostrich manifests much affectionate solicitude. Each pair is expected to hatch three broods annually. The hens average fifteen eggs at a sitting, and occasionally have as many as thirty. The period of incubation lasts about six weeks, and the week-old chicks are as large as good sized turkeys. Patent incubators were formerly used, but better results are now obtained by allowing the birds to multiply in the natural manner.

The digestive powers of the bird are proverbial. At the California ranch they are allowed to exercise themselves on nothing more indigestible than an unlimited supply of pebbles. In addition to these, the daily ration of each bird consists of about fifty pounds of cut alfalfa and a little corn. An artesian well supplies them with pure water.

The ranch is operated by a company, which is reticent about its financial affairs. As a second ranch of three hundred acres has been purchased, and Dr. Sketchly is soon to go to the Cape for more birds, the enterprise is believed to pay something beyond its expenses. The Cape Government has become jealous at this transfer of its monopolized industry, and has imposed an export duty of $500 per bird. When this is added to the long carriage and first cost, the average cost of a pair at Los Angeles is at least $1,500 to $2,000. In mentioning the possible profits of the culture, Dr. Sketchly instanced a trio of birds in South Africa which yielded in one year from offspring and feathers a total revenue of $30,000. If the supply does not increase too rapidly for the demands, the profits should not be less than this in California. Labor is probably much higher than in Africa, but the home producers have the advantage of a 35 per cent ad valorem tariff. The artificial treatment of the feathers, such as dressing, curling, and coloring, is carried on chiefly in New York and Paris.

Ensilage of Mulberry Leaves.

During the silkworm rearing season in Northern Italy, a large quantity of mulberry leaves are sent by rail from one place to another, and in many cases the railway administration run special night trains for this purpose. The leaves are packed loosely in sacks, and often arrive at their destination far from fresh, and consequently, if not totally unfit, at all events cannot afford a wholesome food for the nourishment of these insects. An experiment was made during the present season, by a silk producer in Lombardy, in sending the leaves compressed, and for this a bale was made, weighing 116 kilos, by placing the leaves between two round pieces of board (in this case the bottoms of barrels), and compressing them in an ordinary wine press; the bale was then firmly secured with iron wire. By some oversight, this bale of compressed leaves, made on the 23d of May, was not forwarded to Milan, and from thence to Niguarda, until the morning of the 30th, and consequently it did not arrive at its destination until later. On opening the bale, the leaves, with exception of about two inches in thickness round the outside, were found to be perfectly fresh and sweet, and even these were only faded, and found to be not unfit for food. This is a conclusive proof that the nutritive qualities of the leaves can be preserved for some time, if compressed, and the air thus excluded from them; care, however, must be taken not to crush them and injure their tissues by excessive pressure. From that it would appear that a system of ensilage might be adopted with advantage for preserving mulberry leaves in the same way that it is for forage. Another advantage of such a plan would be that the leaves so compressed would be reduced in bulk, and consequently fewer trucks would be required to carry a given quantity of leaves than there is in the ordinary way; and by ensiling the leaves grown on the warmer side of the Apennines, as for instance on the "Riviera" of Genoa, etc., it would be possible to supply the silkworm rearers of Piedmont and Lombardy during backward seasons, or when, from other causes, the leaves are scarce and expensive.

Cocaine a Cure for Seasickness.

Dr. Manasseine, of St. Petersburg, gives an interesting account of the employment of cocainum muriaticum in seasickness (*Berl. klin. Wochenschrift*, August 31, 1885). He argued from its usefulness in the vomiting of pregnancy that it would likewise be of value in this bugbear of ocean travel. He made a voyage himself in order to test the drug, and, finding among his fellow passengers a man and a woman who were especially prone to the malady, made the following observation: Upon embarking, he administered to each every two or three hours a teaspoonful of a solution containing two and a half grains of muriate of cocaine in five ounces of distilled water, with the addition of a sufficient quantity of rectified spirits of wine. In spite of very rough weather for a period of forty-eight hours, both individuals escaped sickness for the first time in their lives. He also treated successfully a six year old child after it had begun to be sick, and a girl eighteen years of age who had been sick for twenty-four hours before the cocaine was given. Her case being severe, she was given a double dose every half hour, and the result is described as being "truly magical." She remained well during the rest of the voyage. Similar results followed in three milder cases. The writer thinks it justifiable to infer that in this drug we have a certain and harmless remedy against seasickness.

PHOTOGRAPHIC NOTES.

Glacéing Gelatine Paper Negatives.—When gelatine paper is used in the making of paper negatives, it is desirable to dry the paper in such a manner that the gelatine surface will present a smooth appearance like glass, in order that the sensitized albumen paper, upon which the positive print is made, may be in perfect contact in the printing frame. Two simple methods are employed. After the manipulation of preparing a paper negative is finished, the latter is slightly drained and laid face down upon a sheet of hard, smooth, vulcanized rubber, and the back pressed over with a rubber squeegee, which carries off the superfluous water. As it dries, the edges will become separated from the rubber, and when peeled or pulled off, which it readily does without sticking, the surface of the negative possesses a brilliant gloss, perfectly even and uniform.

Both sides of the rubber sheet may be utilized in this way. The paper dries quite rapidly in about half an hour.

Glass may be used in place of rubber; but in order to prevent the film from adhering, it is necessary to rub over its surface a drop or two of any kind of oil, and apparently with a piece of cotton cloth, flannel, or paper polish up the glass, as if one were trying to take off every particle of oil.

Enough will remain to answer the intended purpose, and it will be found that the paper will easily strip off, by loosening or raising it at one corner.

The highest gloss will be given if fine plate glass is used. Thin paper, unless dried in this way, will invariably cockle up in creases or patches in the center, and render the obtaining of a sharp positive print somewhat difficult.

Aqua Ammonia in the Fixing Bath.—It has been found that the use of ammonia in the fixing bath for the fixing of silver prints prevents the bleaching out of the picture as much as it would otherwise do; and in the experience of many who have tried it, the following proportions have been ascertained to be the best:

Water	8 ounces.
Hyposulphite soda	1 ounce.
Aqua ammonia	1 drachm.

Chevreul the Centenarian Scientist.

On the last day of August, according to *Nature*, Professor Michel Eugene Chevreul entered upon his 100th year. Apart from the fact, that among men whose lives have been devoted to active scientific research, no one has before attained such an age, Chevreul stands conspicuous for the vast amount of work he has done, and for the great practical effect his work has had on the industries of the world. When Dumas, in 1852, addressed him on the occasion of handing to him the prize of 12,000 francs accorded to him by the Societe d'encouragement pour l'industrie nationale, he said: "Le prix consacre l'opinion de l'Europe sur des travaux servent de modele a tous les chemistes; c'est par centaines des millions qu'il faudrait nombrer les produits, qu'on doit a vos decouvertes."

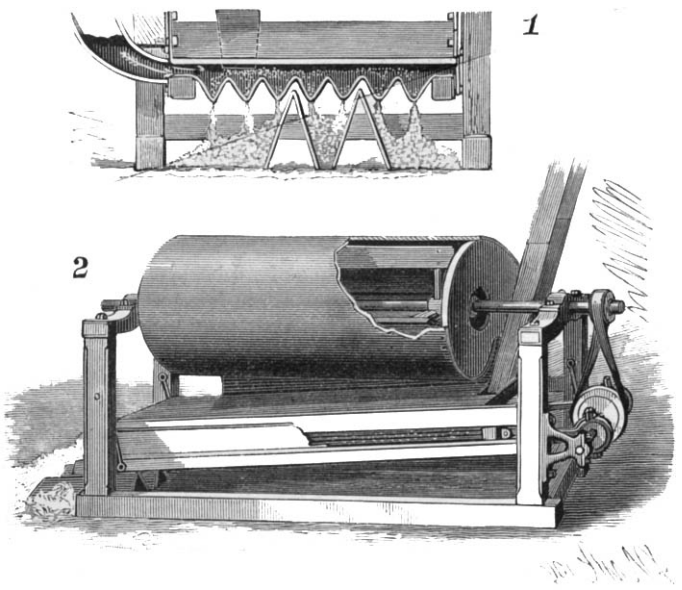
More recently, in 1873, when the award of the Albert medal was made by the English Society of Arts, the terms in which the council expressed the grounds of the award were: "For his chemical researches, especially in reference to saponification, dyeing, agriculture, and natural history, which for more than half a century have exercised a wide influence on the industrial arts of the world."

His scientific work, apart from its commercial outcome, was recognized by the Royal Society of London as far back as 1826, when he was elected a foreign associate. In 1857 the Copley medal was awarded to him. Other countries have also paid him honor, while the distinctions of his native land have showered upon him. Born in Angers, in 1786, where his father was a physician of note, he was but seventeen when he went to Paris to be "manipulateur" in the laboratory of the celebrated Vauquelin. At the age of twenty he published his first chemical paper, and in the next half dozen years he had published more than a score on different subjects. Then began that series of papers (commencing in 1813), "Recherches chimiques sur plusieurs gras, et particulierement sur leurs combinasions avec les alcalis," which extended for many years.

In 1824 he was appointed Professor of Chemistry at the famed factory of Gobelins; and the energy and untiring industry which was one characteristic of his work soon accumulated stores of knowledge based on experiment. To exact experiment he attached the highest importance. He wrote, in 1823: "Experiment is not chemistry, facts alone do not constitute that science; but we cannot have discoveries without exact experiment." His "Recherches sur la teinture" is an elaborate work; and his "Moyen de definer et nommer les couleurs" occupies the whole of vol. xxxiii. of the Memoires of the Institute. It has often been remarked that it is difficult to believe that the Chevreul of "corps gras" fame and the Chevreul who wrote on colors are one and the same man.

PURIFYING AND SEPARATING MIDDLINGS.

The extensive introduction of modern milling machinery has added greatly to the importance of all devices calculated to more thoroughly separate the products at the different stages in the processes of high and low grinding. The illustrations herewith show an improved purifier and separator, Fig. 2 giving a longitudinal sectional elevation, with part of the fan casing broken away, and Fig. 1 showing an end elevation. Beneath the fan, and supported in the same



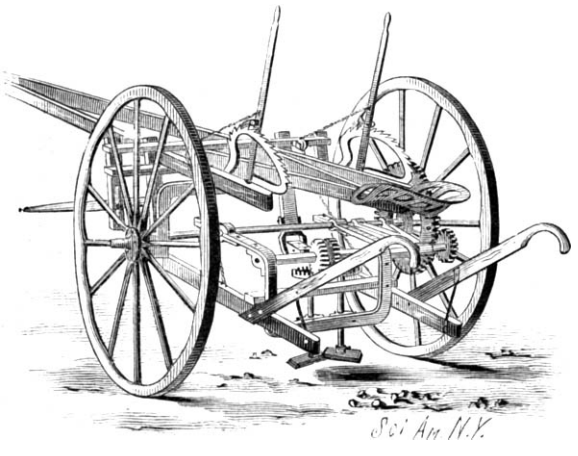
HOWARD'S MIDDLINGS PURIFIER AND SEPARATOR.

frame, is a longitudinally corrugated plate, with a downward inclination toward its tail end, and above this plate is another one, which can be adjusted closer to or farther from the corrugated plate, to regulate the effect of the blast of air. As the middlings are passed through the feeder, the corrugated plate is vibrated in connection with the air blast from the blower, spreading the middlings over the surface of the plate, while the vibrations cause the light, fluffy particles and the fine bran to rise to the surface, where they will be blown out by the air blast through the space between the upper and lower plates, while the heavier and more valuable parts will pass down the grooves and escape at their lower ends into any desired receiver, the more valuable portions being in the groove next the fan blower, and becoming less valuable in the grooves toward the other side of the machine. Beneath the lower end of the corrugated plate are placed angular division plates, to separate the products into such degrees of fineness or purity as may be desired.

This invention has been patented by Mr. Edward W. Howard, of Montevideo, Minn.

COTTON CHOPPER ATTACHMENT FOR CULTIVATORS.

Mr. Hans Henriksen, of Duarte, Cal., has patented an improvement in cutting attachments for cultivators which is intended more especially for use in the cotton field, and is so made that it can be adjusted to cultivate the plants and at the same time remove a certain proportion of them, or to be available as a simple cultivator, as may be desired. The mechanism, as will be seen from our engraving, is quite simple. A rod, placed in such a position as to be in line with the axes of the wheels, has the forward ends of the arms of a U-shaped bar pivoted to it in such a manner that the bar can be moved forward or back. At about the center, the bar is bent vertically downward, and, with the aid of the transverse bar joining its two arms, supports the bearings of two vertical shafts.



COTTON CHOPPER ATTACHMENT FOR CULTIVATORS.

To the upper end of the shafts are attached gear wheels, which engage with pinions on a horizontal shaft supported in bearings at the angles of the U-shaped bar. A pinion on the end of this shaft receives motion from a toothed wheel connected with the right hand wheel of the cultivator. Cutting blades are attached to the lower ends of the vertical shafts at their centers; and the arms of the blades being longer than half the distance between the shafts, will overlap slightly, but as one shaft is shorter than the other, the blades do not interfere. As the blades revolve, a diamond-shaped space is left between the intersections of the paths of each arm, in which the plants are undisturbed. Provision is made for adjusting the position of the vertical shafts and their actuating pinions, so that the blades will intersect more or less as it is desired to remove a greater or less number of plants. When the machine is to be used as a simple cultivator, the blades are replaced by small disks, which leave the plants undisturbed along the whole row.

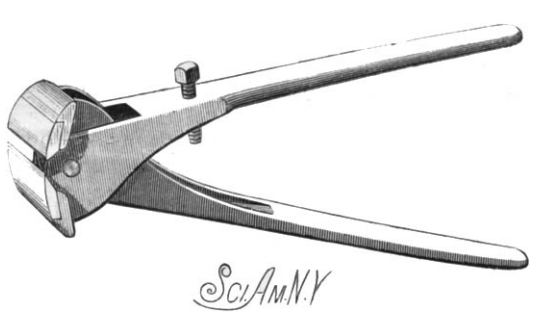
Both blades and disks operate under the surface to loosen the soil, and the depth to which they penetrate is regulated by the two levers shown on top of the machine. The arrangement of the device makes it both simple and effective.

White Herons.

Among the entertaining features of the State carp ponds are two white herons under domestication. Mr. Logan Terrell winged two of these snow white creatures, and has for some days kept them tied to a pole with a small cord. At times he takes the birds upon his arm, and conveys them to the edge of the large pond. Then, throwing in bits of cracker, he attracts myriads of shiners and roaches near the feet of the birds, who immediately begin to feed. One fish after another is caught between the beak and swallowed head foremost. It is strange that, as slick as a fish is, they never drop one. Each bird takes forty-five fish per day, the minnows being 4 inches long. Mr. Terrell wonders why any fish exist when such greedy foes beset them every day.—*Raleigh Register.*

CUTTING NIPPERS.

In the common nippers, where the rivet or wire to be cut cannot be passed between the sides of the jaws,

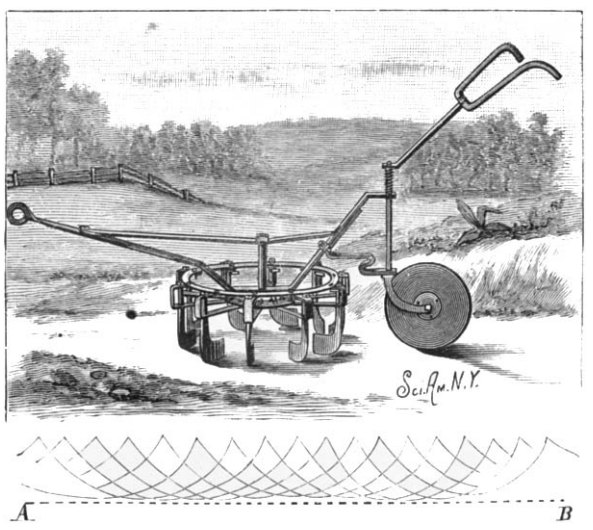


BROADBROOKS' CUTTING NIPPERS.

the cut is diagonal, and must be made at the ends of the cutting edges. The accompanying engraving represents nippers, the invention of Mr. Peter Broadbrooks, of Batavia, N. Y., which overcome this objection. The two jaw levers have their upper ends forked, and the prongs of one lever pass between the prongs of the other. The prongs are pivoted together by two rivets, one in each pair of prongs, or by a single rivet passing through all four prongs. The cutting blades are held by screws in recesses formed in the upper ends of the levers. In one lever is arranged a stop screw. As the pivoted ends of the levers are forked, an opening is formed between the sides at the pivots, thus permitting of passing a wire between the cutting blades and between the sides of the levers. The wire can thus be cut at the centers of the cutting edges and at right angles to the length of the wire.

REVOLVING CULTIVATOR.

The object of the invention herewith illustrated, which has been recently patented by Mr. John T. Campbell, of Rockville, Ind., is to facilitate and promote thoroughness in cultivating small plants, loosening the soil, and covering grain. The inner ends of eight radial arms are attached to a hub pivoted to the lower end of a short vertical shaft attached to the frame of the machine. The outer ends of the arms are bent upward at right angles and then inward, and in the ends are pivoted steel teeth whose lower parts are bent to the rearward and widened vertically. The sections of the teeth that pass through the upper and lower parts of the outer ends of the arms are made round, so that they will turn freely; and the sections between the upper and lower parts are made square, to correspond with the square eyes of short bars which are fitted loosely upon the square sections. To the radial arms are attached pins in such positions that the bars will strike against them when the teeth have turned so far in one direction as to bring the blades into radial positions, but will allow the teeth to turn freely in the other direction until the bars come in contact with the edges of the upright parts of the radial arms. When it is desired to have the frame revolve in the other direction, the bars are raised, swung over the pins, and

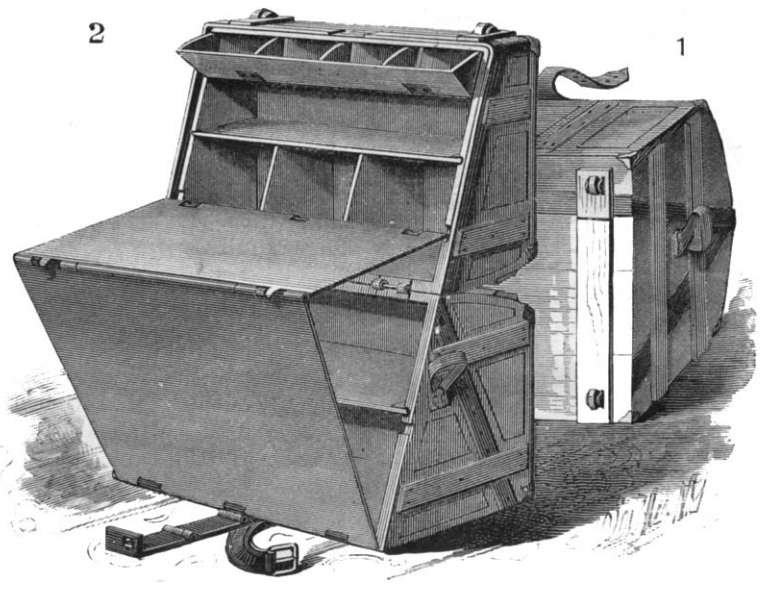


CAMPBELL'S REVOLVING CULTIVATOR.

dropped at the other side. The cultivator is made to move forward in a straight line by a circular rudder attached to a vertical rod, the lower end of which is pivoted in the rear end of a bracket secured to the rear inclined bar of the main frame. The handles by which the rudder is controlled, and the machine thereby guided, are attached to the upper end of the vertical rod. When the cultivator is drawn forward, that side upon which the blades are held from swinging back by the rods and pins will be held by the blades from moving forward, while the other side will move forward more quickly, the teeth describing curved lines (the diagram shows clearly the track made by the cultivator, the dotted line A B representing the row of plants, and the curved lines the paths of the blades), and their blades swinging back, and offering less resistance to the advance of that side. The curved forward sweep of the blades causes them to push all clods and lumps away from the plants and at the same time to thoroughly loosen the soil.

IMPROVED TRUNK.

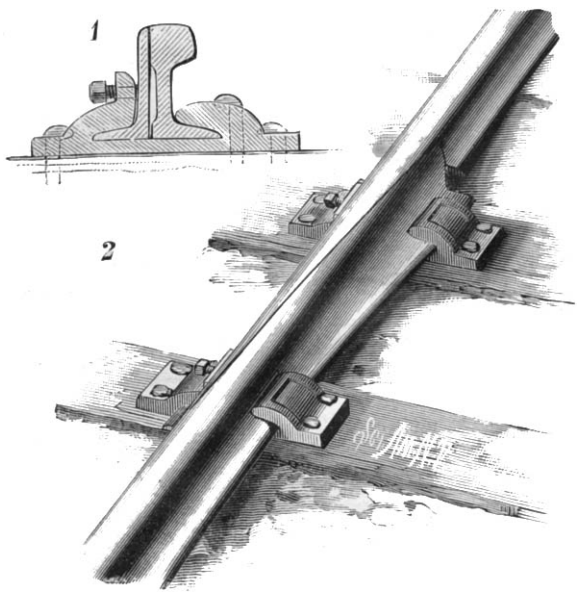
This trunk is so constructed that it can be erected and adapted for use as a wardrobe, desk—as shown in Fig. 2—or table, or can be adjusted as a support for a mattress or other bedding. The trunk is formed of two sections, shown clearly in Fig. 2, hinged to each other; the plane on which the two sections are divided is diagonal, so that when the front section is swung up on the rear one, a wardrobe or box is formed, which increases in width and thickness from top to bottom, and is closed by lids hinged to each other. The rear section is provided with a horizontal partition dividing it into two compartments, and the front or upper section has two horizontal partitions. Vertical partitions form a



WULFF'S IMPROVED TRUNK.

series of compartments in the lower part of the upper section, for holding hats, shirts, or other articles. The upper part of the section is divided into pigeon holes, which can be closed by a swinging leaf formed with partitions corresponding with those making the pigeon holes, and dropping within them when the leaf is closed. The two lower horizontal partitions are hinged

so that they can be folded down against the backs of the compartments when they are not needed. The sections are furnished with lids hinged to each other, the lower one being hinged to the front edge of the bottom of the rear section. By placing the lower lid against its own section and swinging the free end of the upper lid downward and outward, when it may be held at any desired inclination by suitably ar-



LARKIN'S RAILROAD RAIL JOINT.

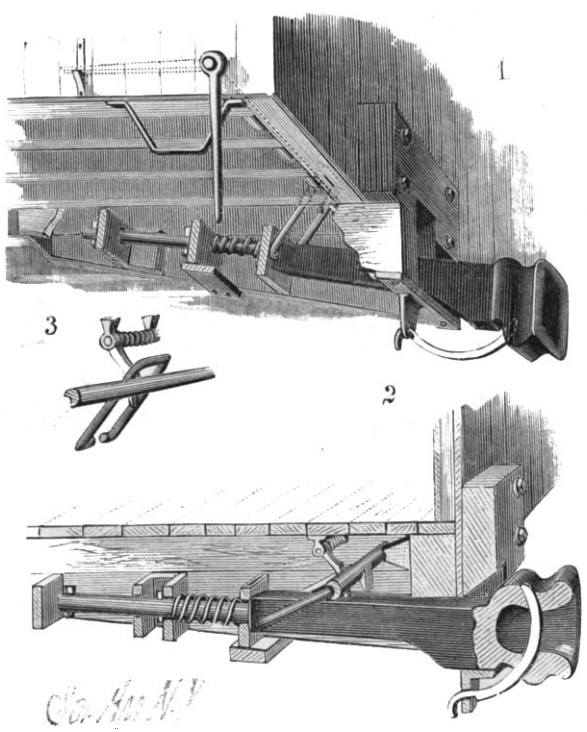
ranged straps, a table may be formed. When the lids are on their respective sections, the trunk may be laid down so as to rest on the back of the lower and front of the upper section, thus forming a support for mattresses or bedding. As trunks, in Mexico, are used extensively as furniture, this one ought to prove a good article of manufacture for that country.

This trunk is the invention of Mr. Henry F. Wulff, of San Antonio, Tex.

IMPROVED CAR COUPLER.

The engraving represents a car coupler that will take up the link as it hangs from the mouth of the drawhead to be coupled, and securely couple the same by pressure of the cars in coming together, without the aid or supervision of an attendant. It can be uncoupled at any time, whether the cars are at rest or in motion, from the platform, top, or side of the car; the uncoupling can be performed under any strain or tension, thus avoiding the necessity of "backing up" the engine for the purpose. It can be uncoupled without immediately separating the cars, and so left, when the cars can be drawn apart at any time thereafter, the coupler always assuming at the instant its position for uncoupling automatically. It may be made to couple to heights varying six inches or more.

As the drawhead is moved inward by the cars coming together, the outer end is raised by a bevel formed on its under side sliding upon a flat crosspiece extending across the lower side of the drawhead opening. A flange projecting downward from the crosspiece is pro-



BUCKMAN'S IMPROVED CAR COUPLER.

vided with an aperture, through which a hook on the lower inner end of the curved coupling pin is passed; as the drawhead moves inward, this pin enters suitable openings in the head and holds the link, as will be understood from Fig. 2. The drawhead is held securely in its inner position by a rectangular frame (Fig. 3), whose lower end is pivoted to the rear part of the drawhead, and whose upper end rests, when coupled, in a longitudinal groove formed in a rod extending across the car, and provided at each end with a handle for turning it, as shown in Fig. 1. The locking link is held securely in place by a cam arm, whose spring presses it against the link. On the cross rod is an arm, which acts, as the rod is turned, to free the end of the locking link when the cars are to be uncoupled. Upon releasing this link, the drawhead can be pulled out a certain distance, and will rest in position (Fig. 1) for coupling.

This invention has been patented by Mr. Thomas E. Buckman, of Jacksonville, Fla.

RAILROAD RAIL JOINT.

Fig. 2 is a perspective view and Fig. 1 a cross section through the joint and one of the chairs of a rail joint invented by Mr. John C. Larkin, of Whitefield, N. H. This joint is designed especially to prevent switch rails from binding, so that they can be set at any time without cutting the ends of the rails. The joint can also be used at any part of the track where it is desired to make allowance for the expansion or creeping of the rails. The rails are by preference made 8 feet long, and the adjacent ends are beveled for a distance of 4 feet, and are placed with their beveled sides overlapping each other. The base flanges of the beveled parts are widened from the beginning of the bevels to the ends of the rails, so that the edges of the flanges will be parallel with the beveled sides of the rails. The beveled parts are placed in chairs firmly spiked to the ties. The rail adjacent to the switch rails is held securely in place by spikes driven through holes in the chairs and recesses in the rails into the ties; this rail is always in such a position as to form a proper joint with the switch rail and allow the latter to be easily set at any time, the movement being wholly confined to the other rail. The arms of the chairs at the side of the movable rail are extended upward along the web of the rail and are provided with set screws, the forward ends of which rest against the rail, so that the wear of the rails can be taken up. The rails are made exactly alike, so that their positions can be reversed when necessary to equalize the wear upon each.

The Change of Foliage.

The immediate cause of the change in the foliage during the fall lies in the lessened action of the breathing organs or pores of the leaves, resulting from a loss of warmth and light due to the shorter days. The natural stimulants to vegetation are withdrawn. Shortly before the fall of the leaf, a very delicate layer of cells starts from the side of the stem and grows downward, completely separating the leaf from any participation in the life circulation of the plant. This explains the smooth surface exposed on separating a mature leaf from its branch. With the cessation of the circulation of the sap, the leaves no longer absorb carbonic acid gas and give off oxygen. The great natural process of deoxidation is arrested, and finally reversed—oxygen is absorbed. The *chlorophyl*, or leaf green, which gave color to the leaves during the earlier part of the season, is now oxidized and changed to *xanthophil*, or leaf yellow, and *erethrophyl*, or leaf red.

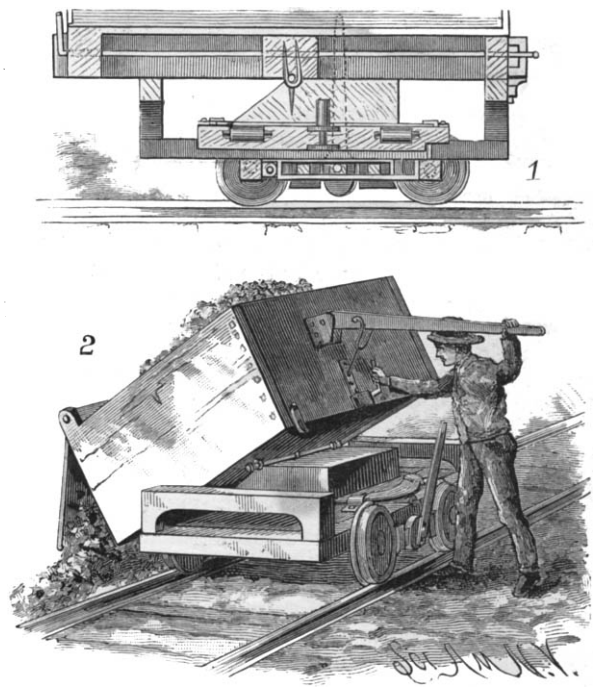
These new salts contribute nothing to the nourishment of the leaf. No carbonic acid is absorbed from the atmosphere, and the leaf soon dies and falls to the ground. The difference in the coloring of the leaves depends upon the local conditions, which hasten, modify, or retard this chemical reaction. In the so-called evergreens, no transverse cell formation takes place, and the leaf is never separated from the circulation of the main tree. They also evaporate less in proportion to their leaf surface than ordinary trees. Their more sluggish circulation is less dependent upon climatic influences.

Right and Left Handed.

A right-handed man is a man who takes hold of a hoe, a rake, a spade, or a fork, with the right hand down and the left hand up, or nearest the body. A man who habitually puts his left hand down, or, for instance, the man who places his right hand on the top of a spade, and grasps the handle or shake with his left hand, is a left-handed man. And so with an ax. A right-handed man and left-handed man can work together in chopping down a tree. If they were both right-handed or both left-handed, they could not do this unless one chopped on one side of the tree and the other on the other side. And so it is in loading earth into a wagon. If the men stand face to face, one should be left-handed and the other right-handed. In hoeing a row of corn, the right-handed man will walk on the left side of the row, while the left-handed man will walk on the right side of it.

DUMPING CAR.

The improved dumping car herewith illustrated unloads either sidewise or endwise, and is so constructed that the car and load cannot be thrown off the track when running on an uneven surface. The truck bed is provided with a pin projecting into the bed plate, and with friction rollers on which a disk, projecting a short distance beyond the bed plate, rests. One side of the bedplate is inclined, as shown in both drawings. To facilitate unloading, the front end of the car is a trifle wider than the rear. The car body is attached to a frame consisting of side and end beams and a center beam; the latter is hinged to the upper edge of the incline, and the side beams rest on the end beams of the truck frame, as shown in the sectional view, Fig. 1. At the front end of the body is a hinged door, which can be locked or unlocked from the rear by a bent rod. Secured to either the side or rear is a handle, by which the body can be turned on the pin. The brake shoes are operated by cams placed on the ends of a central rod moved by a lever.



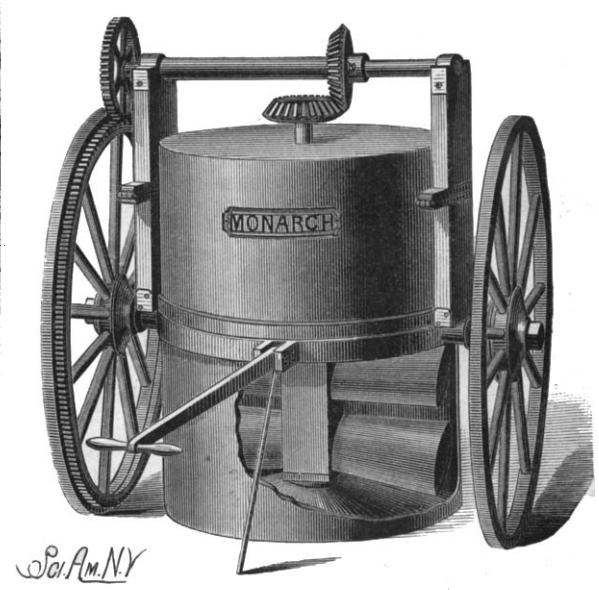
COOK & SUMMERS' DUMPING CAR.

The load is dumped sidewise by unlocking the car frame, unfastening the hinged door by turning the bent rod downward, and then swinging the car body at right angles—to the position shown in Fig. 1—by means of the handle. As soon as the car frame has cleared the end beams of the truck frame, it will tip over on to the incline, as shown in Fig. 2. The load can be dumped endwise by lifting the rear end of the car upward, using the front axle as the pivotal center; the rear wheels remain on the track, as the rear axle is hinged to the front one by a frame. By removing the car body, frame, and bed plate, the truck can be used as a timber car.

This invention has been patented by Mr. S. W. Cook and Henry Summers, of Bozeman, Montana.

THE "MONARCH" CHURN.

The operation of this churn will be readily understood by reference to the accompanying illustration, by which it will be seen that, on simply drawing it across the floor or the ground, motion is communicated to cog wheels operating the dasher. The blades of the dasher are set at an angle, to effect a thorough agitation of the cream, and the lower edges of the lower blades are made to conform to a conical shape of the bottom, formed around the step in which the upright dasher shaft rests. The body of the churn, which is prefer bly of sheet metal, is so supported that but-



PHILLIPS' IMPROVED CHURN.

termilk can be conveniently drawn off at a stopper in the bottom, and it is so hung that it may be readily swung and locked in place for churning, or readily thrown out of such position, to facilitate filling with cream or removing the butter.

This invention has been patented by Mr. Ezra O. Phillips, of Coopersville, Mich.

The Camera as a Detective.

Practical reformers, who have been trying to abolish low concert saloons and other vicious resorts in New York city, have met with opposition from the very people who are presumably their helpers. About some of these places there is sufficient of the ward politician's influence to make even the policeman a consenting party; and consequently he is sometimes quite oblivious to violations of the law which are plain enough to everybody else. This state of affairs has led the reformers to turn to the more reliable testimony offered by a good photograph. The saloons are brilliantly lighted by electricity as a rule, and the reformer, armed with a pocket camera and instantaneous photographic plates, has succeeded in taking over a hundred views of the saloons and streets in front of them after one o'clock in the morning, when the law provides that they shall be closed. A number of the photographs contain clock dials, which thus offer their testimony as to the hour.

Loss of Imported Soles.

Among the freight on board the steamship Gallia, during a recent westward passage, was a consignment of 500 live soles sent over by the National Fish Culture Association of Great Britain. On reaching New York, however, not one of the fish was alive, for the shippers had neglected to place any sand in the bottom of the tank, into which the fish could have burrowed and had a comparatively tranquil passage. As it was, they were pitched from side to side in the bare tank, and were literally beaten to death during a severe storm encountered on the second day out. The agent of the American Fish Commission had arranged for the transfer of the soles to the piscicultural establishment at Wood's Holl, and was greatly disappointed to be obliged to consign them to New York Harbor. The next consignment will probably be sanded.

Transplanting Trees and Shrubs.

My experience of many years, says William Smythe in the *Gardeners' Chronicle*, of transplanting work with evergreen shrubs proves the advantage of early autumn planting. The soil at this season has a higher temperature during the next two months, and there is more humidity in the atmosphere than in the spring or during the winter. I have always thought trees and shrubs of all kinds succeed best when transplanted in the months of September and October. The roots are then quickly developed, and the injury and check caused by transplanting are soon rectified, the plants becoming re-established before winter sets in. Where alterations and new plantations are contemplated, every available means should be used to complete the work as early as possible. Where large specimen trees or shrubs have to be removed, they should have been prepared twelve months previously by cutting a trench completely round and partially underneath them, so as to sever all the roots at a proportionate distance from the stem, according to the size and nature of the tree.

Many trees which furnish fibrous roots plentifully will succeed with a comparatively small ball of earth, but others, especially the Coniferæ and many tender kinds of evergreens, require a larger ball and greater care to insure success. Great care and attention should be given by refilling the trench with rich, light soil, so that the trees may more easily form a mass of fresh roots, which can be much easier removed without injury in transplanting. Having prepared the trees, the site to which it is intended to remove them should next be considered. One thing important is to provide thorough drainage, as without this few trees or shrubs will succeed where the subsoil is not sufficiently porous. To prevent water stagnating at the roots, drains of rubble or stones should be used for the purpose, about a foot below the bottom of each hole, and it is advisable to get out good, large holes, and as deep as requisite for the subjects to be operated on. The soil that I find suitable for most kinds of trees and shrubs is a good, light, turfy loam; the more turf, the better.

Having made all preparations beforehand, and having the proper mechanical arrangements in readiness for conveying the tree to its intended position, care should be taken not to injure the roots in transit, and in placing it again in position; the roots should be laid out straight at various levels, and afterward covered with fine soil, which should be well washed down with an abundance of water, and then the soil should be filled in and well rammed, and made quite firm all round the tree; a good mulching of long manure, 5 inches thick, should be spread over the surface; the tree should be staked and tied firmly. The operation will be complete if the above instructions are carefully carried out, and early autumn planting, and greater care in the operations of transplanting trees and shrubs, will succeed, and be sure to give satisfaction.

MICROSCOPIC EXAMINATION OF CILIATED ORGANISMS BY INTERMITTENT LIGHT.

BY GEORGE M. HOPKINS.

Every observing person has noticed that moving objects appear stationary when viewed by a flash of light; examples of this are seen during every thunder storm occurring in the night. The wheels of a carriage, a moving animal, or any moving thing, seen by the light of the lightning, appears perfectly stationary, the duration of the light being so brief as to admit of only an inappreciable movement of the body while illumination lasts.

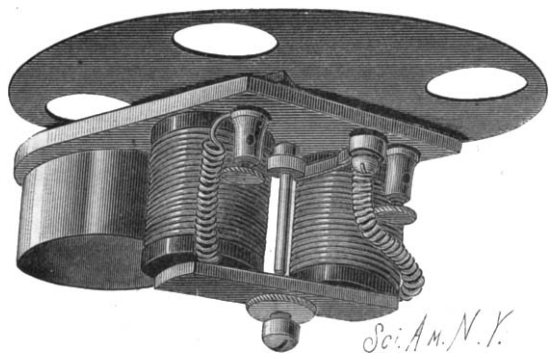


Fig. 1.—LIGHT INTERRUPTER FOR THE MICROSCOPE.

If by any means a regular succession of light flashes be produced, the moving body will be seen in as many different positions as there are flashes of light. If a body rotating rapidly on a fixed axis be viewed by light flashes occurring once during each revolution of the body, only one image will be observed, and this will result from a succession of impressions upon the retina, which by the persistence of vision become blended into one continuous image. In this case no movement of the body will be apparent; but if the flashes of light succeed each other ever so little slower than the rotatory period of the revolving body, the body will appear to move slowly forward, while in reality it is moving rapidly; and should the light flashes succeed each other more rapidly than the revolutions of the revolving body, the body will appear to move slowly backward, or in a direction opposite to that in which it is really turning. These curious effects are also produced when the number of the light flashes is a multiple of the number of revolutions, or *vice versa*.

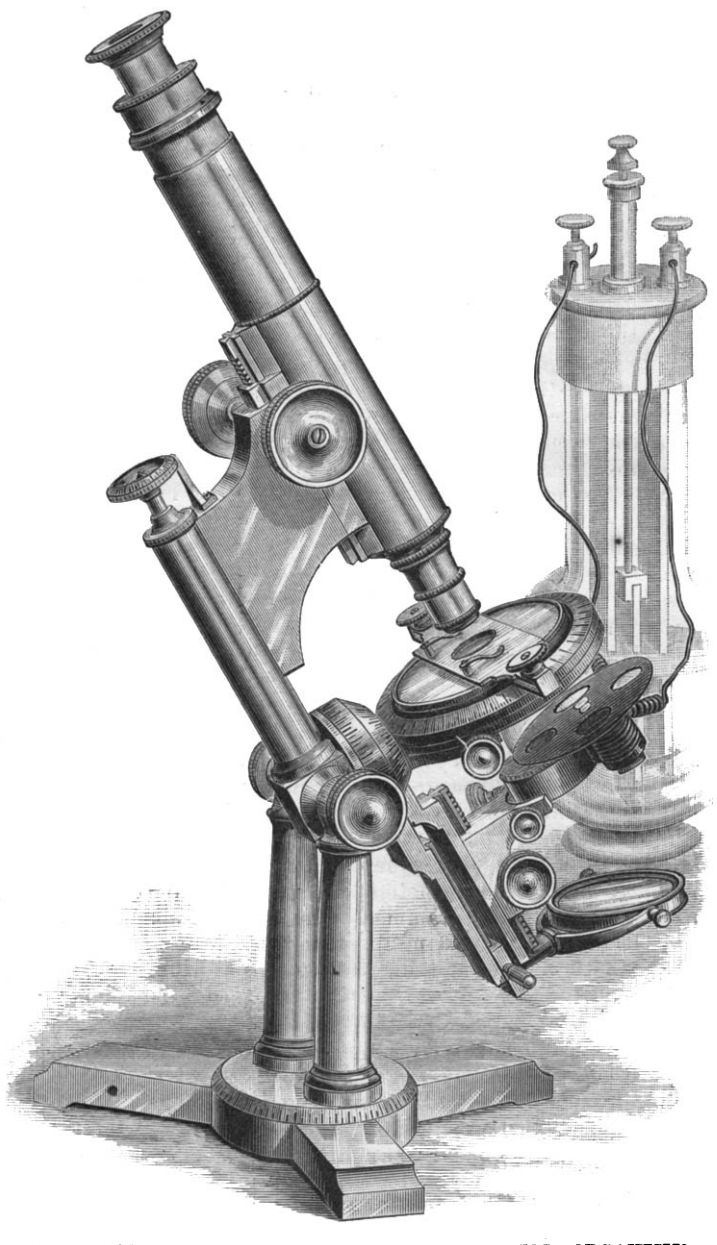


Fig. 2.—MICROSCOPIC EXAMINATION OF CILIATED ORGANISMS BY INTERMITTENT LIGHT.

The combined effect of interrupted illumination and persistence of vision may be practically utilized for examining objects under motion which could not otherwise be satisfactorily studied. To apply intermittent light to the microscopical examination of ciliated organisms, the writer has devised the electrically rotated apertured disk shown in Fig. 1, which is arranged to interrupt the beam of light employed in illuminating the object to be examined.

The instrument consists of an electric motor of the simplest kind mounted on a plate having a collar fitted to the substage of the microscope, as shown in Fig. 2. The shaft, which carries a simple bar armature before the poles of the magnet, also carries upon its upper extremity a disk having two or four apertures, which coincide with the apertures of the stage and substage two or four times during the revolutions of the disk.

The shaft carries a commutator, and the course of the current from the battery through the instrument is through the spring touching the commutator, through the shaft and frame of the instrument to the magnet, thence out and back to the battery. There are two methods by which the speed of rotation of the apertured disk may be varied; one is by plunging the elements of the battery more or less, and the other is by applying the finger to the shaft of the motor as a brake, the motor in the latter case being started at its maximum speed, and then slowed down to the required degree by the friction of the finger. Experiment shows that the period of darkness should be to the period of illumination about as three to one for the best effects. Closing two diametrically opposite holes in the disk represented in the cut secures about the correct proportion.

Various rotifers examined by intermittent light showed the cilia perfectly stationary. The ciliary filaments of some of the infusoria, Vorticella and the Stentor, for example, when viewed by intermittent light, appeared to stand still, and their length seemed much greater than when examined by continuous light. The interrupted light brings out not only the cilia around the oral aperture, but shows to good advantage the cilia disposed along the margin of the body. What interrupted light may reveal in the examination of flagellate or ciliated plants the writer is unable to say, as no objects of this character have been available. It is presumable, however, that something interesting will result from the examination of Volvox and other motile plants, by means of this kind of illumination. Although it is necessary to interrupt the beam of light regularly, for continuous observation, the effect of intermittent light may be exhibited to some extent by an apertured disk like that above described, twirled by the thumb and finger or revolved like a top by means of a string; or by using a larger apertured disk fitted to a rotator, and placed between the source of light and the mirror of the microscope.

The Flood Rock Explosion.

Professor W. A. Rogers, of the Harvard Observatory, has reported to the American Academy of Arts and Sciences, in Boston, the results of his observations on the transmission of shock from the Flood Rock explosion.

The air line distance between the observatory in Cambridge and Flood Rock is 190 miles, and the observations were timed as follows: Disturbance first seen, 11:17:14; instant of maximum disturbance, 11:18:03; disturbance ceased, 11:20. The figures are all in seventy-fifth meridian or "Eastern" time. The method used to develop the existence of vibration was the placing of a saucer of mercury on the solid cellar floor. In this mercury was a speck or flaw. Upon this point was brought to bear a microscope of 750 magnifying power, the spider line being in exact coincidence with the flaw.

The first vibration perceived was about a thousandth of an inch, and recurred at intervals for nearly two minutes, the greatest swaying of the mercury being over a space of one five-hundredth of an inch.

In this connection it is interesting to note that General Abbot reported that the shock from 50,000 pounds of dynamite, exploded in 1876 at Hallet's Point, was transmitted through the drift formation of Long Island, at the rate of 5,300 feet per second for 13½ miles. Assuming the figures of the Cambridge report as correct, and that the mine at Flood Rock was exploded at 11:14, seventy-fifth meridian time, it took the wave just 194 seconds to travel 190 miles, or at the rate of 5,120 feet per second. This is very near the rate of transmission observed by General Abbot, when the greatly increased distance is taken into account.—*Engineering News.*

THE Genesta arrived at Portsmouth, England, on the 28th of October, having made the trip across the Atlantic from New York in 20 days and 10 hours.

Correspondence.

Can a Celestial Body Fall to the Center of Its Attraction?

To the Editor of the Scientific American:

Newton demonstrated that from gravity a moving orb will assume an orbit corresponding to one of the four conic sections, with the controlling body at the focus of the curve. Now, from this law, is it possible for a celestial body to fall to the body around which it revolves, *i. e.*, to leave the perimeter of its orbit and pass to the focus thereof? It has been said, even by men of science, that were the earth stopped in its orbit it would fall to the sun. If Newton be correct, the earth, thus stopped, would not fall to the sun, but would make a perihelion passage around that body and assume a new orbit, for, from the moment it started toward the sun, it would move and continue in a curve of a section of the cone. A binary system of stars is an example where suns have fallen toward each other, but, keeping to their mathematical curves, have made mutual perihelion passages without ever coming dangerously near each other.

If Newton's theory is correct, Mayer's theory of solar maintenance (from meteoric impact) is untenable.

E. B. WHITMORE.

Rochester, N. Y.

A Plan to Heat the Cold Wall.

To the Editor of the Scientific American:

Instead of damming the Straits of Belle Isle to keep out the cold water, as so ably suggested by Mr. John C. Goodridge in your paper of October 31, I propose that we place waterwheels and friction contrivances in the Straits, so as to heat the water as it comes through during the winter season. Stop the wheels in summer.

By these simple expedients the water will be made to warm itself, and a southerly moving, genial, warm stream will be produced, to soften and temper the climate of the adjacent countries during the winter; while the refreshing coolness of the cold wall may still be enjoyed in summer. Furthermore, this plan obviates all risk of changing the climate of Europe or Great Britain.

I hereby file this my caveat of priority upon the general idea of making streams of water heat themselves in winter by friction, without the use of coal—applicable to all great rivers, such as the Hudson, Ohio, Mississippi, Missouri, and others in this and other countries, which are now frozen solid, and commerce suspended in winter. Incalculable benefits to the world must ensue when my discovery is adopted.

O. B. SERVER.

The Word "Atlantic."

To the Editor of the Scientific American:

Referring to Dr. Le Plongeon's note, in your edition of the 7th instant, I have to deny that my former note contains any error—even a "tiny wee" one. When I used the expression "sea beyond Mount Atlas," I did not offer it as a translation of the Greek words, but merely as explanatory. Dr. Le Plongeon, in attempting to correct a supposed error of mine, has "put the cart before the horse" in his translation of the Greek words as the "open sea Atlantic," since the meaning is just the reverse, viz., the "Atlantic open sea," or, to substitute an equivalent English adjective for the Greek one, the "Atlasian open sea."

In answer to Dr. Le Plongeon's query as to where the Greeks obtained the word *'ατλαντικος, -κη, -κον*, I would say that they formed this adjective from *Ἄτλας* (gen. *Ἄτλαντος*). As I before intimated, the ocean was so-called because it lay beyond Mount Atlas. As regards the etymology of Atlas, I would say that the best Greek scholars derive the word from *α* (euphonic) and *τλας*, participle of *τλῆναι*, 'to bear,' 'to endure,' which is from the Aryan root *tal*, 'to bear,' 'to lift,' 'to sustain,' whence also Sanskrit *tul*, 'to lift,' Latin *tollere*, 'to lift,' 'to bear,' Gothic *thulan*, 'to endure,' Anglo-Saxon *tholian* and English *thole*, 'to endure.' (Cf. also the derivative *Atlantes*, used in architecture as a name for male figures employed in place of columns to support an entablature.) The meaning of the word is evidently the 'bearer' or 'sustainer.' How the mountain came to receive the name of the god is a question of mythology which does not concern us.

So much for the Greek; now for the Nahuatl: Dr. Le Plongeon derives the word *atlan* from *atl*, 'water,' and *tlan*, 'near,' 'between;' but the real meaning is, rather, 'water country.' *Titlan* is, in Aztec, a locative suffix meaning 'land,' 'place,' 'country,' and, in its abbreviated forms, *-tlan* and *-lan*, is found in many place names; for example, Mazatlan, 'deer country,' Quauhtemallan (whence Guatemala), 'wood-pile place,' Huaxtlan, 'land of acacias,' Tzapotlan, 'land of the sapote,' Mixtlan, 'land of clouds,' etc.

G. W. R.

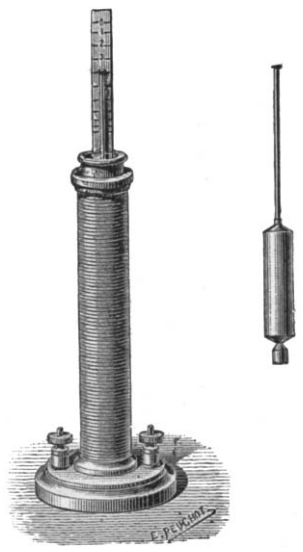
A NEW APPARATUS FOR MEASURING ELECTRIC CURRENTS.

BY MR. F. DE LALANDE.

These new amperemeters and voltameters are made without permanent magnets, thus removing common cause of error. The principle on which they operate is based on the action of a solenoid on a bunch of soft iron wires placed movably within it, and maintained by an opposing force.

To obtain this result in a practical way, the apparatus is formed of a bunch of soft iron wires placed within a float, and put in a test tube filled with water, and surrounded by a bobbin through which the current to be measured passes. The initial position of the float, regulated by the constant level of the liquid, being always the same, it is evident that it will have a positive fixed equilibrium, sinking to a certain depth, which is varied by the strength of the current which passes through the bobbin, but is always the same for the same electromotive force. The upper end of the rod of the float forms the index, which moves over a vertical graduated scale. The float rod passes through and is guided by a metallic eye in the liquid, thus preventing friction by contact with the sides of the tube.

By varying the dimensions of the bobbin and of the bunch of soft iron wires or of the float rod, a movement of any desired length can be obtained for a given current. In the models, which have been very carefully made by Mr. Carpenter, a displacement of ten centimeters (4 inches) corresponds to a current of from 10 to 25 amperes, or an electromotive force of 100 volts.



The bobbins of the amperemeters are formed of only one or two layers of very coarse wire; they may have a resistance of only one one-hundredth to two one-hundredths of an ohm; the apparatus can, then, be introduced without inconvenience in almost any electric circuit. The bobbin of the voltameter is of fine wire, and has a resistance of about 1,700 ohms.

The apparatus is very sensitive, and is not visibly affected by changes of temperature, by the presence of metallic masses, or even by powerful magnets.

Experiments with the Lime Cartridge.

M. Mathet in *L'Echo des Mines et de la Metallurgie*, has recently described some experiments which have been made at the Blanzy mines, with a view to determine the bursting power of lime cartridges before employing them on a large scale, the cable testing machine supplied by Falcot, Meyret & Co., of Lyons, being used to measure the pressure. The cartridge was cylindrical in form and of the following dimensions: Diameter, 65 millimeters; length, 86 millimeters; surface of base, 33·16 square centimeters; total surface, 241·76 square centimeters; volume, 285 cubic centimeters; weight, 550 grammes. The cartridge was inclosed in a lead casing 3 millimeters thick, which it fitted exactly, a space of a few millimeters only being left for the admission of water. The whole was then introduced into a cast iron cylinder, provided with two openings, one of a large size serving for the introduction of the cartridge, the other being to enable the whole of the vessel to be filled with some incompressible liquid; this latter opening was hermetically closed by a plug. The larger opening was fitted with a cast iron cylinder in which a piston moved, and this piston was in connection with the testing machine. The cartridge being placed in position, water was injected, and the outer vessel filled with mercury. After one and a half minutes, the balance registered a pressure of 2,000 to 2,500 kilogrammes; after this first period of pressure there were a few moments of repose, after which the pressure again gradually increased, the results of a large number of experiments showing final pressures varying from 3,160 to 6,600 kilogrammes; but these figures are considerably lower than the real pressure exerted by the cartridge, as a leakage of mercury could not be avoided. The cartridges used in the experiments were manufactured at Montceau.

A Natural Gas Forge.

The *Petroleum Age* thus describes a recent trial at Kendall, Pa., of Dr. Benninghoff's patent process of smelting iron, steel, and glass with natural gas. Iron and steel were quickly raised to a white heat in a well controlled flame, which came from mixing natural gas with air, and the metals were easily and thoroughly welded.

The invention seems likely to revolutionize the smelting of iron, steel, and glass in the United States. The forge is built of brick, about 33 inches square at the base and 30 inches in height. The firepot is located at the central point, and near the top of the forge. Inch air pipes coming from the fan or blower are connected to three-quarter inch gas pipes just outside and on opposite sides of the forge. At the T the gas and air are mixed, and then pass into the forge through the same pipe. The two pipes from opposite sides are in a horizontal line with one another, and have their open ends in the forge directly opposite and sixteen inches apart. When they are lighted, the two flames strike against each other. An air pipe in a vertical position from the bottom of the forge has its open end about eighteen inches below the horizontal line between the pipes containing gas and air. The intense heat is obtained near the intersection point of the air current and the mixed ones of air and gas.

The top of the forge is nearly closed, with the exception of an aperture large enough to admit the piece of iron or steel to be welded. When the two gas jets are first lighted, the flame rises to a height proportionate to the flow of gas. But when the air is forced into the air pipes and mingles with the gas, the flame changes from a yellow to a lambent blue color, as it settles into the firebox in the forge. Why the jet of flame sinks instead of rises is something as yet unexplained by those who have brought about the valuable results. Dr. Benninghoff describes his invention as a process in which gas is mixed with air under pressure, so as to make it in the highest degree combustible. He also says, the oxygen in the air being the important factor of combustion, all that is necessary is to supply a sufficient amount of air to get the required amount of oxygen to perfectly consume the gas. Gas burning in an ordinary jet for the purpose of light gives that light because it is not all consumed. Where combustion is perfect, there is no blaze or flame to be seen. In order that the air supply may not interfere with the heat supply, the gas is mingled with the air before it is introduced into the firebox. In arranging a forge it may also be necessary to add extra air blasts to the fire for the purpose of locating the heating place, and for supplying oxygen in case there be any non-oxygenized gas present.

Hand Grenades.

It seems to us that some one might do his fellow-citizens a good turn by telling the truth about the fire extinguishing hand grenades which are sold now in such enormous quantities. There are so many varieties of them that we will not attempt to say what they are all filled with, but, so far as we have been able to ascertain, not one gives out, when thrown into a fire, any of those efficacious gases which they are popularly supposed to contain, and we have yet to hear of any which possess more virtue than inheres in a bottle of salt and water, or of alum solution; while the disadvantages of their employment are considerable. It is not many weeks since smoke was discovered, early one morning, proceeding from between the floor boards in our own office, and a rush was made for the hand grenades by the few persons who happened to be in the building. A washstand with two faucets stood within ten feet of the smoking floor-boards, just outside the door of the room, and pails and pans were not far off; but instead of availing themselves of this obvious means of attacking the faint threads of smoke which were alone visible, the amateur firemen threw their grenades apparently at random over the room and the adjoining closet, completely ruining with dark chemical stains every object of value upon which the liquid contained in them was spattered, but of course producing no effect upon the fire beneath the flooring.

Finally a four inch hose was dragged into the room from a standpipe near by, and, after cutting a hole through the floor, a stream was turned in large enough to drown a lively conflagration, completing the destruction which the perfectly useless hand grenades had begun, and, like them, accomplishing nothing which two quarts of water, applied with a little common sense, would not have done equally well, without incidentally spoiling a considerable part of the contents of the office, as well as of that under it. If the grenades contained nothing but water in a convenient shape, there would be no great objection to them; but the mystery of the ingredients which fill them gives them a false value in the eyes of the ignorant, who forget all about using the water pails close at hand in their anxiety to invoke the mighty genii of the blue bottles, and thus throw away the precious opportunity which, in fires, never comes but once, and lasts only a few seconds.—*The Amer. Architect.*

ELECTRIC MOTOR ON THE NEW YORK ELEVATED R.R.

(*Continued from first page*).

the electro-dynamic machine. The object of using these laminated cushions is to avoid the too considerable motion which would result from the use of the ordinary springs, and at the same time provide a degree of resilience which enables the machine to run over very rough roads without the least derangement of parts.

The cab contains also a voltmeter, which shows the engineer the difference of potential on the track, just as the ordinary pressure gauge now indicates the pressure in a boiler.

The rails are the ordinary 56 pound steel rail, insulated by means of the Daft insulator, which consists of an umbrella of cast iron with head so formed as to readily admit of locking the base of the rail by means of two cap screws and washers. The standard is formed of any suitable insulating material; the standard now in use on the elevated road consists merely of baked hard wood saturated with asphaltum, which has so far been found to afford ample insulation for all practical purposes — the leakage with four miles of track now involved (two miles of double track), plus the switches, being inconsiderable. The joints are made by drilling holes in the web of the rail, and riveting strips of copper from one to the other; this method has been found entirely satisfactory, both here and on the road now in operation in Baltimore—the resistance having thus been reduced to nearly the calculated line resistance.

No difficulty has been experienced in making the switches, though in some instances a considerable interval has to be bridged by momentum alone, due to the necessity for leaving out the third rail in order to permit the passage of the ordinary steam locomotives; this difficulty would of course be removed in the event of the entire road being operated electrically. The maximum gradient is one of 105 feet per mile between 23d and 34th Streets. This has been surmounted with ease with fairly well loaded trains, and on several occasions an average speed of 20 miles an hour has been attained.

The track is vitalized by dynamos (Fig. 1) situated at the main station on 15th Street, about 200 yards from the track, it having been considered desirable to place the vitalizing machines as near one end of the track as possible, so as to show the influence of distance in lowering the potential.

The effect of these two miles is, therefore, rendered equal to four miles where the station is centrally placed, and the loss of energy at the extreme end is barely observable. The vitalizing system at the station consists of three No. 5 Daft dynamos, actuated by a Wright automatic cut-off steam engine, having a cylinder 18 x 42 inches and a flywheel 16 feet by 26 inches. There is, in addition, a small arc-light Daft dynamo used for lighting the station and boiler room. The machines are connected with a switchboard, so that they can be placed in "parallel" or "series," as may be desired, and there is in addition an automatic cut-off, which operates in the event of a short circuit on the track, so as to open the circuit at a fixed point, and at the same time give the engineer notice by ringing an alarm. There is also an attachment to indicate when the short circuit is removed. The machines are connected to the track by means of 0000 copper wire, with Underwriter's line insulation suspended upon poles.

The motor has already run several hundred miles on the short track at 14th Street, making many hundred stops and starts, involving much severe work, hauling four cars for a considerable portion of the time, and also a two car train, for the purpose of making close observations as to the difference in consumption of fuel. With regard to this all-important question, the tests are as yet necessarily incomplete; but so far as they have gone, the indications are claimed to be eminently satisfactory. The extraordinary adhesive properties of a locomotive operated in this manner are evident. This feature is well illustrated on the line in Baltimore, which at one point has a curve of 75 feet radius on a gradient of 353 feet, and yet no difficulty has been experienced by the motor in ascending this grade with a loaded train. So successful has been the working of the Baltimore road that two more motors have been ordered, making a total of four.

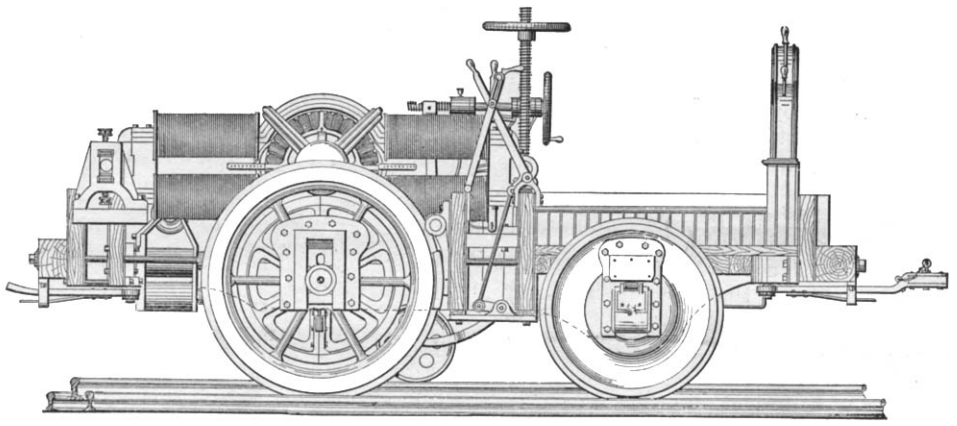


Fig. 3.—SIDE ELEVATION OF THE ELECTRIC MOTOR

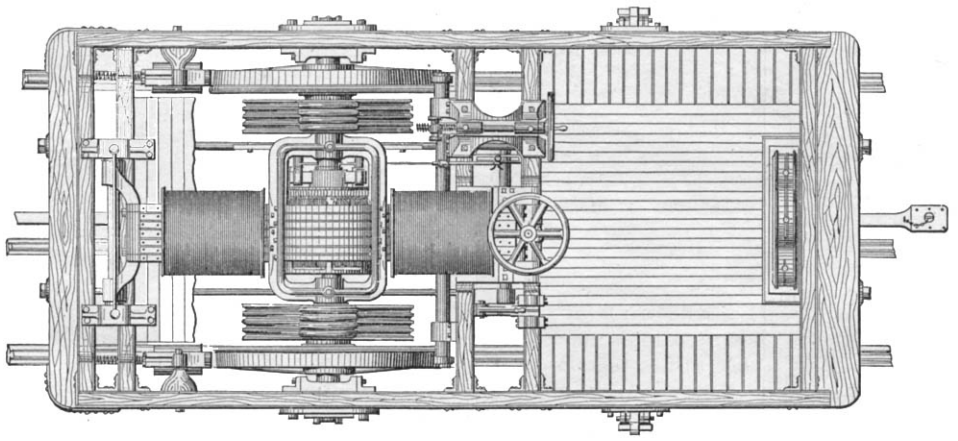
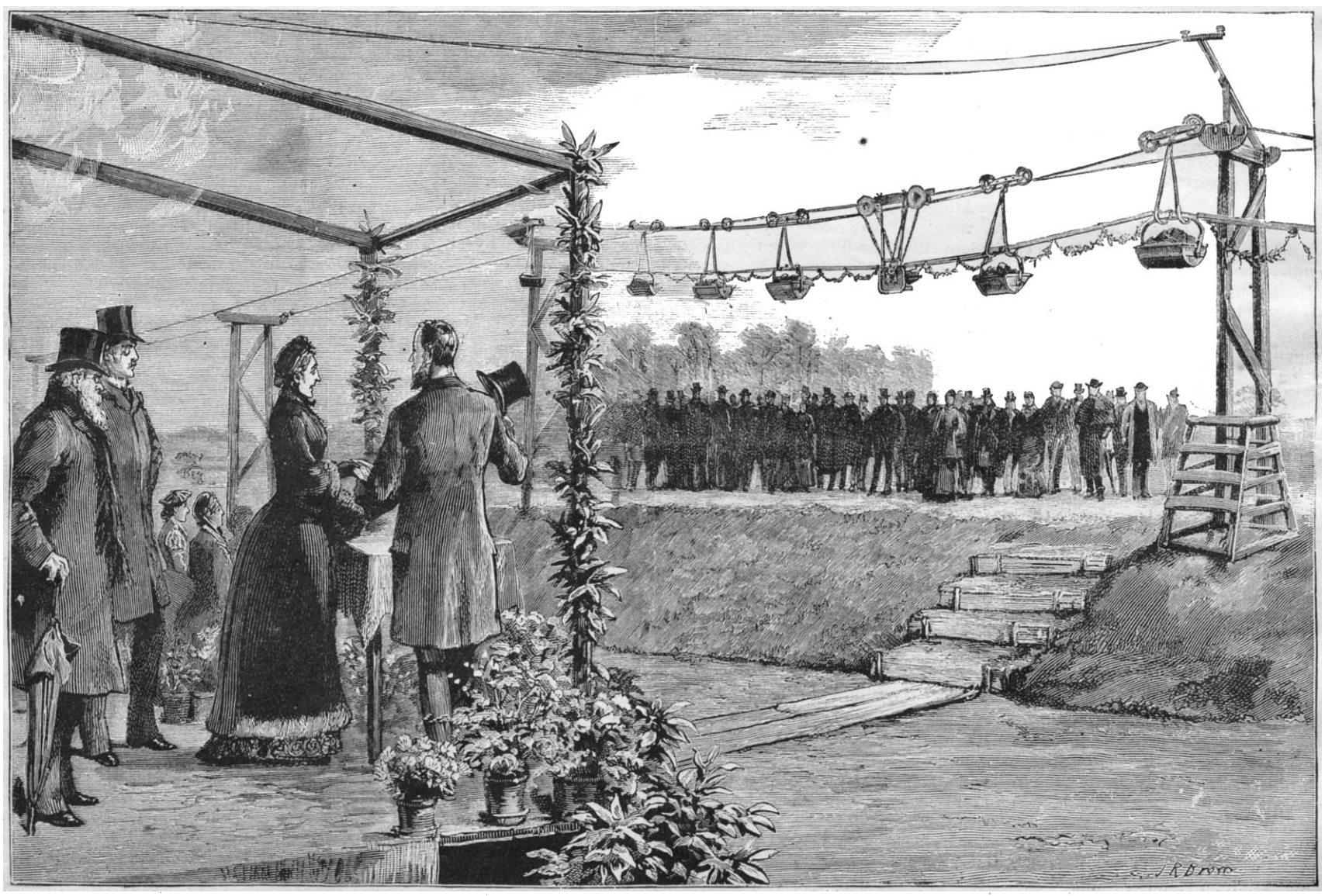


Fig. 4.—PLAN VIEW OF THE ELECTRIC MOTOR.

OPENING OF A TELPHER LINE.

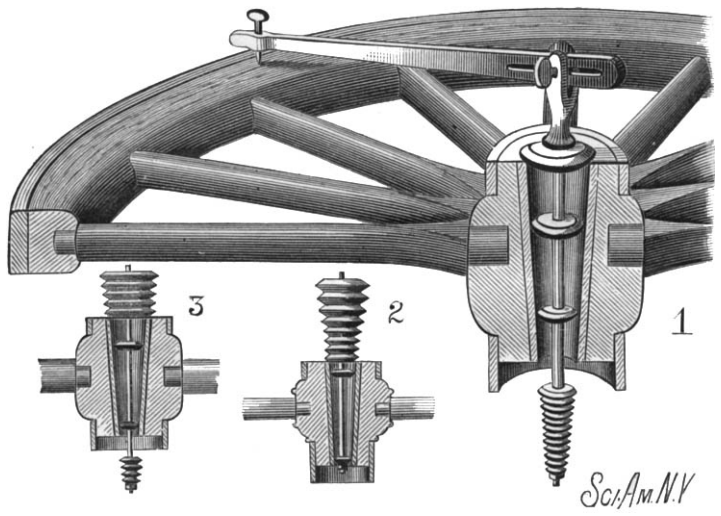
The experimental telpher line at Weston, under the system of the late Professor Fleeming Jenkin, has resulted in the construction of a telpher line to do real work at Glynde, on the estate of Lord Hampden, near Lewes. Professor Fleeming Jenkin had begun the construction of the Glynde line, Mr. Arthur Brewtnall being his assistant. After the death of Professor Fleeming Jenkin in June last, Professor Perry was appointed his successor as the engineer to the Telpherage Company. The Glynde line has now been completed, and was opened October 17th, by Lady Hampden, who started a loaded train on the line electrically. The line is a double one, nearly a mile in length, and is composed of two sets of steel rods, ¾ inch in diameter, supported on wooden posts of T shape, and about 18 feet high. The wires are supported one on either end of the cross piece of the T, which is 8 feet long. The carriers, or skips, as they are technically termed, are iron



OPENING OF AN ELECTRICAL CABLE RAILWAY OR TELFER LINE AT GLYNDE, ENG.

trough-shaped buckets, each holding about 2 cwt., and suspended from the line by a light iron frame, at the upper end of which is a pair of grooved wheels running on the line of rods. A train is made up of ten of these skips, which are in electrical connection with each other and with an electrical motor, which is placed in the middle of the train, having five skips in front of and five behind it; the dynamo machine used as the motor is of Reckenzaun's design. At a point about midway of the length of the line is the engine house, in which is a steam engine for driving the dynamo machines. From these latter the current is led to the line, and thus to the electrical motor which moves the train. The use to which the line is put is to carry clay from a pit to the Glynde railway siding, whence it is delivered into trucks and transported by rail to the works of the New Haven Cement Company. At the charging end of the telpher line, the skips are loaded each with about 2 cwt. of clay, the train thus carrying 1 ton. A laborer, by touching a key, starts the train, which travels at a speed of from four to five miles an hour along the overhead line to the Glynde station. Arrived there, another laborer upsets each skip as it passes over a railway truck, into which the clay is thus loaded. This upsetting, however, will eventually be performed automatically by means of a lever on each skip, which will come in contact with a projecting arm as it passes over the truck.

The laborer at the discharging end of the line has full control over the train, and can stop, start, and reverse it at will, as can also the man at the other or loading end. There are two trains at Glynde, but only one is at present used, that being found sufficient to deliver 150 tons of clay per week at the station. The trains need no attention when running, as they are governed to run at the same speed both on rising and falling gradients. An automatic block system is provided, so that as many as twenty trains can be run on the line without the possibility of collision. The telpherage line at Glynde being the first erected is still capable of improvement in detail, but it successfully demonstrates Jenkin's proposals for working the equivalent of a wire rope railway by electricity instead of by the teledynamic system of Hirn and others, although time is necessary to prove its comparative practical utility and efficiency. Our engraving is from the London *Graphic*. A more detailed description of this system, with several engravings, will be found in SCIENTIFIC AMERICAN SUPPLEMENT, No. 420.



MATERN'S READY HUB-BOXING GAUGE.

CLAY'S IMPROVED SPLIT LINK.

ONE and three-fifths seconds after the gong struck was the time achieved by one of the steam fire engine companies in harnessing up and starting, at the recent horse show in New York.

HUB-BOXING GAUGE.

By means of this gauge the wheelwright is enabled to quickly and accurately center the box in the wheel. Upon a rod provided near its upper end with a fixed collar, and at its lower end with a nut, are rings, which are made successively smaller in diameter toward the lower end. The top of the rod is held by a set screw to the slotted end of a gauge arm; the slot allows the rod to be set nearer to or farther from the marker at the other end of the arm, to suit wheels of different diameters. The form of the gauge rings or collars is clearly shown in the cut. To use the gauge, the rod with the rings is passed into the hub-box, when two or more of the rings will bind against the tapering inner wall of the box, to form a true bearing for the rod at the exact center of the box; the gauge arm is then set so that the marker will stand at about the joint of the felly with the tire. The rod and arm may be together turned around the wheel, so that the indicator will show at the periphery whether the box stands precisely at the center or not.

By providing the rod with a sufficient number of rings, one gauge may be used for almost any ordinary size of wheel.

Fig. 1 shows the gauge applied to a large size box, Fig. 3 to a medium, and Fig. 2 to a small box.

This invention has been patented by Mr. William J. Matern, of Bloomington, Illinois.

Water is Fattening.

It has been observed that water is fattening, that those who drink large quantities of water have a tendency to fullness and rotundity. That there is considerable truth in this observation the *Medical and Surgical Reporter* fully substantiates. That excessive imbibition of very cold (iced) water (especially when one is very warm) is not to be commended, yet we have reason to believe that the *unlimited* use of *pure spring water*, at its natural temperature, is not only very conducive to health, but has an actual tendency to favor a fullness and roundness of body. Whether this is the result of a better action on the part of the digestive, assimilative, and depurative functions, owing to the internal cleanliness or flushing of the human sewers produced by large quantities of water, or whether water has some specific action in producing this fullness, we do not know, neither does it signify, since observation confirms as a fact that the free use of water does have this effect.

British Shipbuilding.

Recurring to the subject of depression in the shipping trade, the London *Times* says that in 1884 the result was more unsatisfactory than at any year previously. The tonnage of iron vessels built in 1884 at Tyne, Wear, West Hartlepool, the Tees, Blyth, and Whitby included, amounted to 297,000, or less than one-half the total of 1883. It is added that elsewhere the falling off is equally pronounced. At this time not one-half the building berths at the northern shipyards are employed. Thousands of workmen have been thrown out of work at the shipyards and iron and steel works, and "a correspondent thinks" that the approaching winter will witness a still further depression and distress.

IMPROVED SPLIT LINK.

The link is composed of two parts hinged together. Each part is made of half-round iron, and is formed with an opening and enlargement. The enlargements are so located in relation to the openings as to close the latter, and form a complete and continuous link when the parts are closed, as shown in the lower figure. A cut-away place in each half forms, when the parts are closed, a recess, so that a nail or other small object may be easily inserted between the parts of the link, for forcing it open in case it should not work easily at the hinge. In one form of link, the ends at the openings are oppositely beveled to fit the beveled ends of the enlargements, so that tight joints will be formed when the link is closed; in this form, corresponding projections, formed on the parts, are fashioned into the hinge. In the form shown in the engraving, the hinge is formed in the material composing the body of the link, and the ends of the openings are cut at an opposite, to fit the diagonal ends of the projections, so that the latter prevent lateral movement of the parts upon each, thereby preventing strain upon the hinge. With the form of construction the little fins of metal which always form at the inner edges of the link, in the use and wear thereof, in no way interfere with the opening of the link, as such fins do with links that open and close edgewise with the parts sliding upon each other.

Further information concerning this invention can be had from the patentee, Mr. Wm. H. Clay, of Paris, Kentucky.

BUTTONHOLE CUTTER.

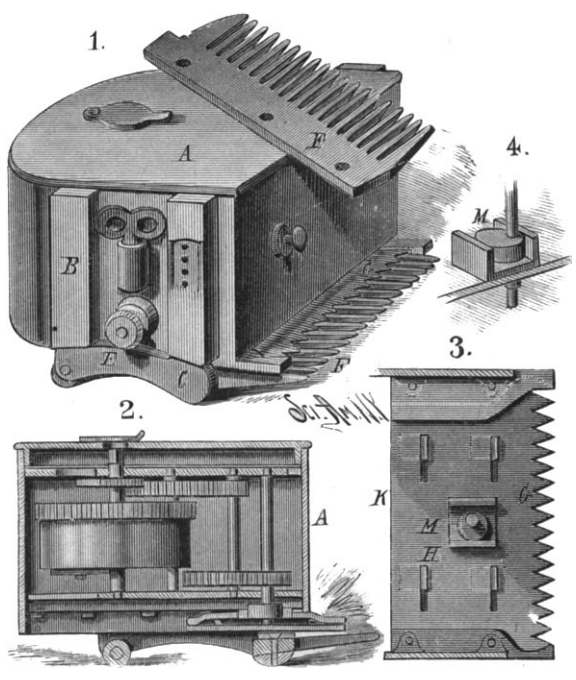
The buttonhole scissors shown in the cut are so constructed that they can be adjusted very easily for buttonholes of a certain size. Each blade is formed with a notch or recess, which constitute the cutting parts. One blade is provided, adjacent to the diagonal edge (each blade has a diagonal edge formed on the rear part of the blade proper) of the other, with a button having a pin mounted to turn in the blade and a handle wing. The button is eccentric in relation to its pivot, and its rim is made polygonal. When the button is in its normal position, its long, straight side comes in contact with the diagonal edge of the other blade. It will be seen that by properly adjusting the button, the cutting edges of the blades may be made to overlap more or less, and buttonholes of different sizes may be cut.

RODER'S BUTTONHOLE CUTTER.

This invention has been patented by Mr. C. A. Roder. Particulars can be had by addressing Messrs. Herman Boker & Co., of 101 and 103 Duane Street, New York city.

HAIR CUTTING MACHINE.

We illustrate a hair cutting machine, patented by Mr. Vladimir S. Bekofsky, of Jenchuan, Corea, which is operated by clockwork, and after winding needs no attention from the operator, other than to be passed over the hair to be cut. Fig. 1 shows a perspective view of the machine, with an extra comb lying on top of the case, Fig. 2 a cross sectional elevation, Fig. 3 a top view of the upper cutting plate, and Fig. 4 a perspective view of the eccentric driving mechanism. A metal box, A, has two upright guides, B, on each end, in which legs projecting from the crosspiece, C, slide up and down. These legs are provided with a series of apertures, as shown by the break in one of the guides, for receiving pins projecting through the box, from the free ends of an interior spring, operated by the push button, E. A comb, F, is secured to the front of the crosspiece, C. Two knife blades are shown immediately above the comb, the upper one of which, G, is provided with longitudinal slots to receive the prongs, H, on the lower plate, K. On the upper plate there are two upwardly projecting lugs, between which an eccentric disk, M, is located, which is mounted on an upright shaft actuated directly from the clockwork. The plate, G, is convex, as shown in cross section, so that only its front teeth and rear edge are in contact with the under plate. Immediately above the push button, E, there is a pocket for holding a key for winding up the clockwork. When the machine is not in use, the mechanism is prevented from operating by a brake lever connected with a push button on the front of the metal box. In operation the button is pressed inward to relieve the clock fan and permit it to rotate. If the hair is to be cut very short, the comb is adjusted as shown, but when it is desired to leave a greater length of hair, the comb is adjusted further from the cutting plates by lowering the crosspieces, C. The machine will be found a great convenience, and will effect a considerable saving of time.



BEKOFSKY'S HAIR CUTTING MACHINE.

Process for Printing Photographs on the Lithographic Press.

BY HERMAN REINBOLD.

The art of printing photographs and other half-tint subjects on a type press has been brought to great perfection, and many of the best process workers are experimenting in this field, with more or less success. The writer, who has given a description of a process of this kind in one of the latest numbers of the *Lithographer and Printer*, and which was well received by the press, has lately made experiments with a process for printing photographs on the lithographic press.

The photo-mechanical processes, known as lichtdruck, phototype, artotype, heliotype, etc., and whose originator was Albert of Munich, have all given more or less good results, though it takes years and years of experience, a good knowledge of chemistry and photography, and even then accidents occur so often, the manipulations are so many, and the process is so slow, that at least here in this country it could not be made a paying business as yet. In Germany lichtdruck is more generally used, and most of the work is printed on the steam press, of a construction expressly made for that purpose.

The principle upon which the photo-mechanical processes is based is that of the action of the light on chrome-gelatine, which, after being exposed to the light, attains properties like those of the lithographic stone. The trouble of these processes is, and always will be, the difficulty of making the gelatine film stick to the glass or metal or stone; and the softness of the film makes it very subject to accidents.

After a number of impressions the film is hurt by the pressure, the prints get flat, the ink is taken up unevenly, afterward the gelatine gets holes and bubbles, and the washing, which has to be done very often, finally spoils it entirely. Therefore with the greatest care only a limited number of good impressions can be taken from one plate.

All efforts to do away with the gelatine have proved to be unsuccessful; and though various substitutes have been mentioned, none of them was satisfactory. The lithographic stone has not a fine enough grain to print a photograph directly on it, as it is done in photo-lithography, and therefore the gelatine is used exclusively either on glass or metal, generally copper.

The writer has made many experiments with gelatine, and his aim was to do away entirely with it, and finally he succeeded in this. The following lines give an exact description of it. It is well known that the process of photography is an electric one, the light having the effect upon the bromide and iodide silver combinations to produce an electric current, which decomposes the silver salts, thereby precipitating the silver as a black, fine powder. Of course, the stronger the light has acted, the more of the salt is decomposed, and thereby the photographic effect is produced. Now, the electric nature of the photographic process can be successfully used for half tone printing in lithography.

A perfectly level zinc plate is polished with fine pumicestone powder and water, until no more scratches are visible. This plate is then amalgamated with mercury by laying it into a pan containing the metal for a few minutes, during which time it is rubbed over with a soft camel's hair brush. When taken out, the little drops of quicksilver adhering to the surface are removed and the amalgamation is quite even, which can be readily seen, as the zinc must look like a mirror; the plate should be kept free from dust before used. In order to prohibit the mercury to dissolve or amalgamate the back side of the plate, it may be covered with asphaltum or varnish.

The plate is now ready to be coated with the sensitive collodion. It is coated in the dark rooms like a negative glass plate with positive or so-called chloride of silver collodion, and dried.

After this it is exposed under a negative from one to four minutes, according to the strength of the negative and the light; but it should never be exposed to full sunlight. Of course it takes some experience to get the right time of exposure, and for the beginning a Vogel photometer may be used with advantage.

In the dark room the picture is developed in the same manner as a glass negative, and cut with hyposulphite of soda and washed. Dry in a heat of about 120 degrees. It will be readily understood that the silver precipitated by the action of the light will form an amalgam with the mercury, while at the other places the mercury will remain intact.

A mixture of two parts of alcohol and one part of ether will dissolve the film, leaving the metals combined.

Zinc has the property to be saponified in the presence of an acid and an alkali, thus prohibiting grease or resin to stick to it. This property has already been used in lithography, and in Europe a great many firms use zinc instead of lithographic stones, both on account of its cheapness and ease of handling it. But the salts used now to bring about saponification are not strong enough; and where the grain is very fine, the plates and prints get soon blurred.

This is due mostly to the resin and acid which the ink contains, and which of course neutralize the alkali. Lately a salt has been discovered by which this difficulty is entirely overcome, and which makes enough zinc soap alkaline to print an almost unlimited number of prints from the same plate without the least difficulty. This chemical is aluminum palmitate ($C_{16}H_{28}O_4 + AlO_2$). One three-thousandth part of it added to benzine is enough to saponify this liquid into a solid body, which will not take any grease or ink.

A bath is made of 90 per cent alcohol and 10 per cent palmitate of aluminum. After having the zinc plate put into a 5 per cent sulphuric acid fluid for a moment, and have it dried, flow the plate with the above bath. When the alcohol is evaporated and the plate washed once more to remove the alumina, the plate is ready to be printed from. No etching fluid or gum is necessary, but it should be washed and wetted just like the stone. If the plate should show a tendency to blur after a number of prints, put it into very weak acid, and afterward in the bath weakened with 25 per cent alcohol. If this does not make it better, the plate was over or under exposed, or the zinc was not clean.

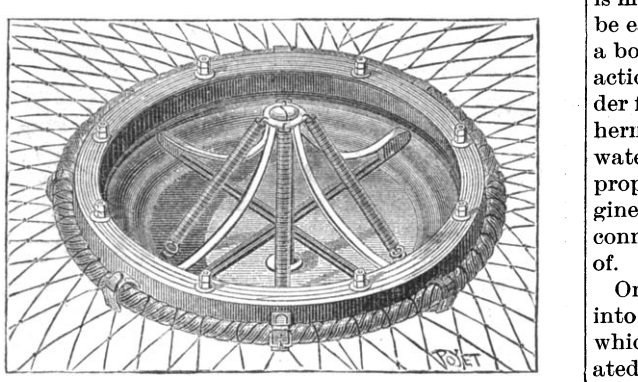


Fig. 2.—UPPER VALVE.

The plate in its appearance is quite level; the light parts are grained, while on the high parts it looks as if polished. The grain obtained in this way is so fine that, it can hardly be seen with the naked eye, and if printed with a photograph tint ink, will make prints equal to the best lichtdruck. Any number of prints can be taken from one plate. The plates cannot be saved, as the action of the oxygen in the air destroys the properties of the chemical combination in a few weeks. Therefore the plates should be used immediately after made. The success depends largely on the negative, like all processes where photographs are used for reproduction.

CAPTIVE BALLOONS FOR ARMY USE.

Some of the military powers of Europe, desirous of an aerostatic plant, and after more or less successful experiments, have been obliged to have recourse to France, that is to say, to the true country of balloons, for the construction of their apparatus. Mr. Gabriel Yon, an old companion of Henri Giffard in his steam balloon experiment of 1855, and the constructor of the Dupuy de Lome screw balloon, as well as of a large number of postal balloons during the siege of Paris, has studied and brought out a system of transportable, captive balloons, for which he has successively received large orders from the Italian and Russian governments. In this the former has priority, and the first captive balloon of Mr. Yon's make, provided with his hydrogen gas apparatus and windlass for ascents and descents, was experimented with at Rome by him and the officers of the Italian army. At these experiments, which took place last July, the Italian Minister of War was also present. The success was complete, and, owing to the results obtained, the Russian Government ordered from Mr. Yon two sets of the apparatus. One of these was recently tested at the Flaud Works, in the vicinity of the Champ de Mars.

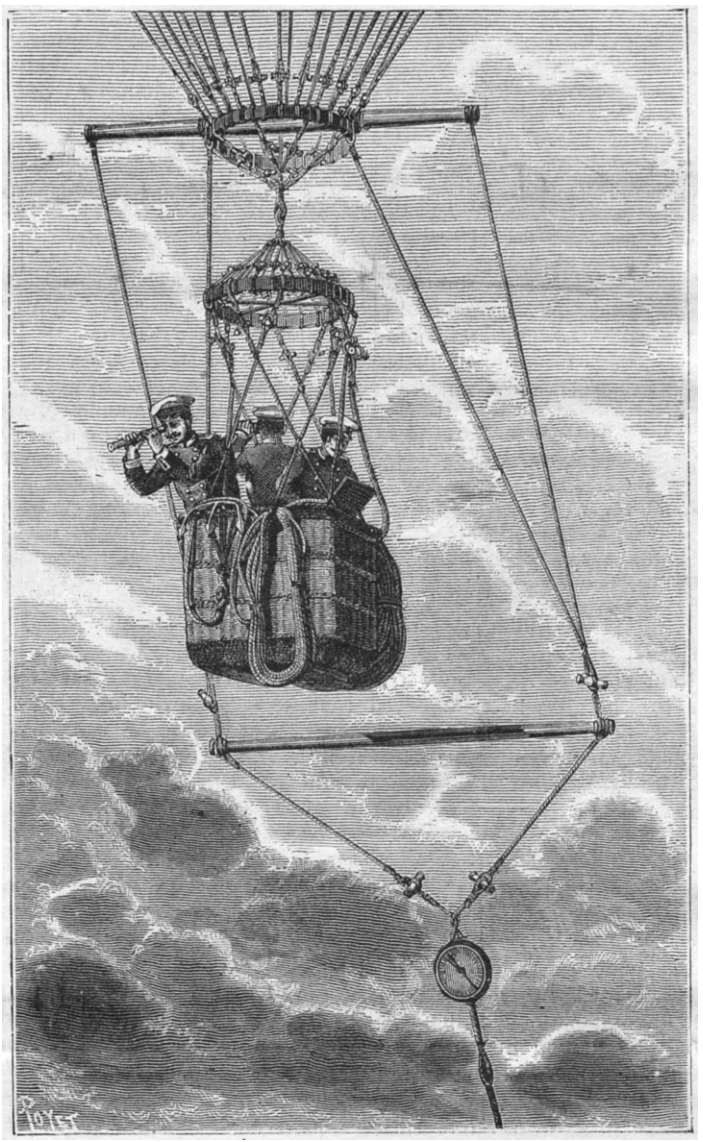


Fig. 1.—CAR OF A MILITARY BALLOON.

As we were present, we shall describe these new and interesting aerostatic apparatus. We shall study in succession the three distinct and independent parts of which they consist, viz.: (1) the balloon, (2) the gas apparatus for inflating it, and (3) the windlass for maneuvering the ascension cable.

The balloon is of Chinese silk, and is of 19,425 cubic feet capacity. The netting is made of Naples hemp. The fabric of the balloon is rendered impermeable by ordinary balloon varnish, having boiled linseed oil as a base. The netting and cordage are covered with a preparation having catechu for a base, in order to preserve them against the action of dampness. The upper and lower valves are of wood and metal combined, and their tightness is perfect, the joint being formed under spring traction, through the pressure of metallic bars upon a band of elastic rubber. The upper valve is seen from above, in Fig. 2, where the four traction springs are clearly shown.

The suspension of the car is very happily carried out. Its connection with the netting occurs at a central point, that allows the balloon to assume all the inclinations possible without moving the car from a vertical position, such a condition being indispensable for the success of the observation. The car, as shown in Fig. 1, is freely balanced between two suspension trapezes that are well combined.

A dynamometer, which connects the ascension cable with the entire affair, permits of measuring the ascensional power at the moment of starting, and of knowing at each moment of the ascent the traction that the balloon is exerting upon the cable. This latter is 1,600 feet in length, and around it is wound an insulated copper wire that permits the officers below to be in permanent telephonic communication with the observers in the car.

The devices for arresting motion, such as the brake-rope and anchor, which are for use in cases of free ascent, are very strong and efficient.

The balloon is inflated by means of a continuously operating hydrogen gas generator. The apparatus in which water is decomposed by iron and sulphuric acid is mounted upon a four-wheeled carriage, which may be easily drawn by two horses (Fig. 3). It consists of a boiler plate generator, lined with lead to prevent the action of the acid upon it, and surmounted by a cylinder for the reception of the iron filings. The whole is hermetically closed by a cap and bolts. The requisite water and acid are distributed automatically, in proper proportions, by pumps actuated by a small steam engine. The steam is led by a large rubber tube, which connects with a boiler that we shall presently speak of.

On making its exit from the generator, the gas passes into a purifier, wherein it bubbles up through water which is continuously renewed by a special pump actuated by the connecting rod of the motor. After this, it traverses two driers, which contain caustic soda and calcium chloride. The two driers are shown to the left in Fig. 3. To one of them is seen adapted the movable pipe, D, of varnished canvas, which leads to the balloon.

The residuum of the reaction, consisting of a solution of iron sulphate, flows to the exterior of the generator through a pipe, A, adapted to a siphon. The pipe, B, permits the water in the purifier to flow out in the same way. The pipe, C, beneath the carriage runs to an external reservoir of water. On a campaign, the feed pump takes its water from a spring, pond, river, or other source.

The weight of the gas apparatus, mounted upon its carriage, is 6,300 pounds, and the production of hydro-

gen is from 8,800 to 17,600 cubic feet per hour of effective running.

The steam windlass for maneuvering the ascension rope is likewise mounted upon a four-wheeled carriage (Fig. 4). It comprises a vertical tubular boiler of the Field type, which furnishes steam to a two-cylinder motor that actuates a shaft whose cranks are at right angles. Upon this shaft is mounted the system of gearings that actuates the traction pulleys. The cable, upon unwinding from the drum under the driver's seat, runs through this mechanism, and is finally connected with the balloon through the intermedium of a universal motion pulley at the upper part of the carriage. This pulley yields to all the inclinations of the cable, as in Giffard's system of captive balloons. The mechanical part is rendered complete by an air brake, which moderates the velocity of ascension, and by a safety brake for stoppages.

The entire mechanical portion, complete, weighs 5,100 pounds, and the effective power capable of being developed by the motor is that of five horses, upon the piston indicator.

In addition to the two carriages and apparatus just described, there is a third carriage for the reception of the folded balloon and its car and accessories. This car, with its appurtenances, weighs 4,840 pounds. A complete aeronautic plant, consequently, weighs 16,500 pounds, distributed between three carriages. The supplies necessary for inflating the balloon and running the engine, that is to say, the iron, acid, and coal, may be placed in the ordinary baggage wagons of an army in the field.

The experiments with the Russian plant last September were a perfect success, and ended with a free ascension by Mr. Yon, his pupil Mr. L. Godard, Jr., and General Boreskoff, of the Russian Engineer Corps. Grand Duke Vladimir, having been informed of these experiments, has become deeply interested in aeronautic affairs, and we believe that, owing to his recommendation, the government of the Czar is about confiding to Mr. Yon the construction of a steerable steam balloon designed for the study of aerial torpedo warfare.

The importance of the long neglected balloon is today being everywhere recognized. Its utility, from a military standpoint, was so well demonstrated by the aerial postal service during the siege of Paris that all nations are desirous of having an aerostatic equipment. Following France, England and Germany have organized captive balloon services, Italy and Russia are following their example, and, before long, other countries will be pursuing the same course. Captive balloons for observation may, in certain cases, secure a victory by informing the general in chief as to the strength of the attacking corps and as to the maneuvers they are performing.

How much service would such balloons have been able to render France during the war of 1870, while the enemy was so skillfully hiding its movements!

At a few hundred feet altitude, when the weather is clear, it is possible for the aerial observer to take in an immense panorama, and see everything beyond hills and forests.—*La Nature.*

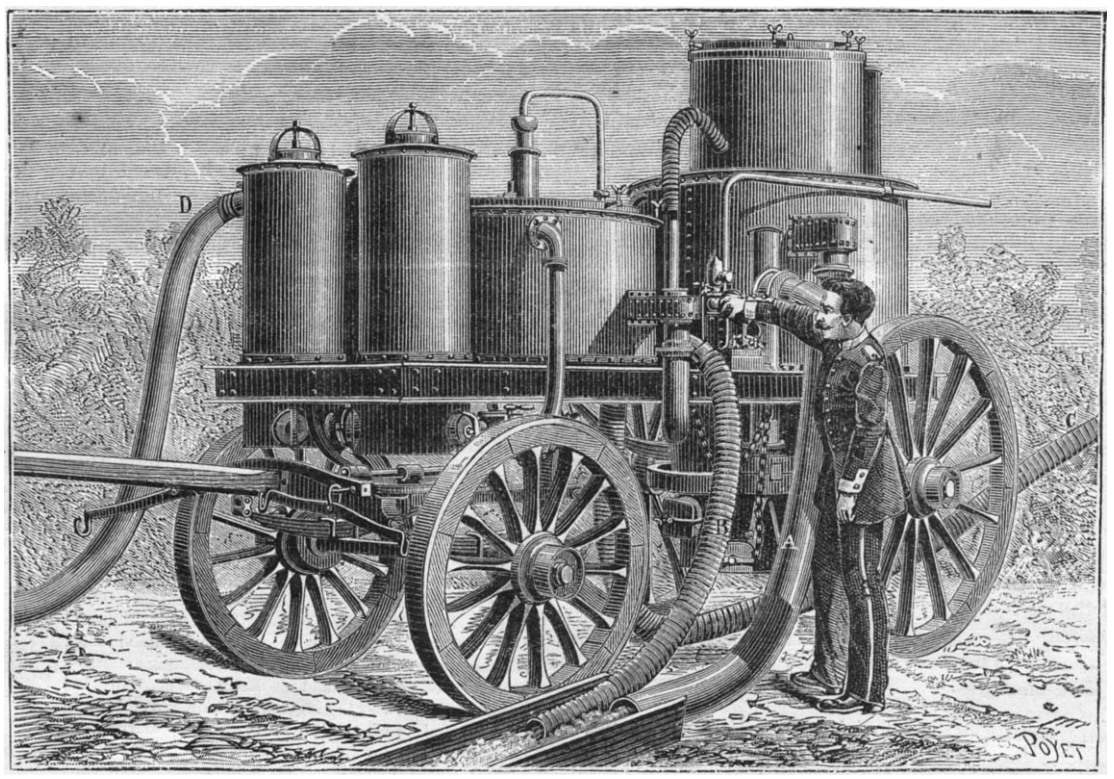


Fig. 3.—HYDROGEN GAS APPARATUS.

A SIMPLE recipe is given in *L'Illustration* for making luminous paper. The composition consists of forty parts ordinary paper pulp, ten parts water, ten parts phosphorescent powder, one part gelatine, and one part bichromate of potassa. The phosphorescent powder is composed of sulphides of calcium, barium, and strontium, well ground and mixed together. The bichromate of potassa acting on the gelatine renders the paper, which is manufactured in the ordinary way, impermeable.

Preservation of Torpedo Boats.

The English Admiralty, having taken into consideration the special character both of the hull and machinery of first and second class torpedo boats, have issued a series of regulations for their more effectual preservation. After reminding officers in charge of the craft that they are built of very thin steel—only one-sixteenth inch thick—and that the utmost care is required in their management, their lordships order that no portion of the hull should on any account be devoid of paint or other anti-corrosive composition in good condition. The bottoms of all torpedo boats in the reserve which are not in use are to be coated with red lead only, and not with experimental composition. Whenever practicable, the boats are to be hauled up or docked for examination every two months, and the interval between such examinations is never to exceed four months.

In order to reduce the amount of corrosion to a minimum, should any of the inside of the vessel be bare of paint or composition, pieces of zinc are to be placed on the inside of the vessel, as low down as possible, so as to be immersed in bilge water, should there be any. The zinc should be in metallic contact with the frames of the vessel, or other parts of the structure if preferred, and the arrangements should be made under the advice of the Admiralty chemist.

Before any torpedo boat is laid up or placed in store, the engines are to undergo a thorough examination, and any defects that may be discovered are to be reported, and, if possible, made good at once. If this is not practicable, the defects are to be made good as soon as possible after the boat is stored. If the boat has been attached to a ship, before being returned to store the chief engineer of the ship is to make good the defects as far as possible.

The engines are to be thoroughly disconnected; the whole of the working parts are to be cleaned and oiled and readjusted. The internal parts are to be drained out, and all the doors and covers are to be so left that periodical examinations may be made of the interiors. The after part of the propeller shaft is to be withdrawn, so that it may be cleaned and oiled, and the stern tube is to be drained out and painted, or otherwise put into a state of preservation before the shaft is replaced. The engines are to be turned several times every week, the boiler is to be thoroughly washed out with fresh water, and the chief engineer is to superintend the examination, and see that the firebox and tube plate are properly gauged, to ascertain if they have received any injury during the time the boat has been under steam. The safety valve and all other boiler mountings are also to be examined, but the safety valve spring is not to be screwed down. After being washed out, the boiler is to be gently warmed to a temperature well above that of the atmosphere, and then closed and kept so.

If unslaked lime can be readily obtained, a small quantity in suitable pans is to be laid on the top of the tubes before closing up the boiler, but the boiler is not to be kept open more than a day or two for this purpose. The bilges are to be cleaned and the bunkers cleared of coal, and the interior of the boat is to be examined throughout, the lining of the bunkers being removed for that purpose if necessary.

Any damage to the paint work is to be at once repaired, and the boat is to be put in every respect in as good a condition, both as regards her machinery and her cleanliness, as when she was issued from store. The Admiralty have authorized some important experiments to be conducted at Portsmouth, with the object of determining the value of liquid fuel for the use of ships of war.

There are various systems before the world, but the particular system which is to be tried is that of Baron Adelsward, which has been largely introduced into the French navy. The coal oil is placed in a tank, where it is raised to a high temperature by steam from the boiler. It is then allowed to pass to the furnace doors, where it comes into contact with a jet of steam and is driven into the furnace, which has been previously heated in the usual way. The inventor claims that his system is suitable for the propulsion of armor clads, but the experiments at Portsmouth will be confined to No. 22 torpedo boat, one of the boats of the largest type, which have lately been received from Messrs. Thornycroft. Should the trials prove successful, there can be little question of the superiority of the liquid fuel over coal for consumption in these small craft, quite apart from the question of economy. In the first place, there will be no stoking required, thus enabling the complement on board to be reduced, and in the next place there will be no necessity for the use of forced draught and the arrangement of fans by which it is produced. These are important advantages when the confined space below deck in the torpedo boats is considered.

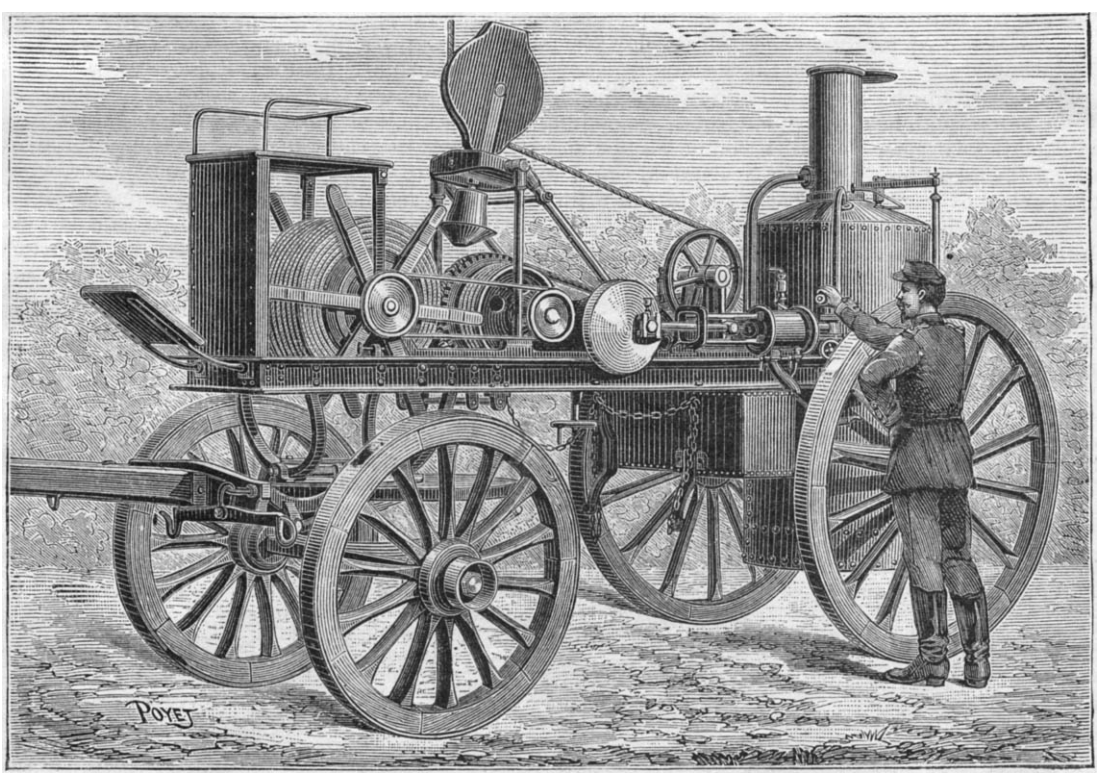


Fig. 4.—STEAM WINCH.

THE project of excavating a tunnel through Simplon for a new railway between Italy and Switzerland is near to its realization. The Italian government promises its co-operation, and the works will be begun next year. The proposed railway line will be 32·6 miles long, of which 7·5 miles will pass through the tunnel; it will cost $13,000,000, and its completion will take 10 years, more than 6 years being required for excavation of the tunnel. On the Switzerland side the tunnel will be 2,260 ft., and on the Italian, 2,656 ft. above the sea level.

ENGINEERING INVENTIONS.

A balanced stop valve has been patented by Mr. William Jackson, of Allegheny, Pa. Combined with a casing having an internal circular seat open at top and bottom, with opposite openings in its sides, is a tubular valve or plug with openings in its bottom, top, and sides, with other novel features, making an equal pressure on all parts of the valve, so that little power is required to turn the plug.

A piston packing has been patented by Mr. William C. McTyeire, of Hatchechubbee, Ala. This invention covers special forms of springs and presser plate seated within the piston head to make a packing to adapt it to the wear of the cylinder, so as to always form a steam tight joint, and one differing from the ring sections and sectional rings heretofore used.

AGRICULTURAL INVENTIONS.

A corn planter and drill has been patented by Messrs. Edgar V. and James V. Mitchell, of Martinsville, Ind. The construction is such that by the revolution of a flanged wheel, secured to the hub and to a driving wheel, the seed slide is carried to the right and left, dropping the grain twice in the revolution of the wheel, and there are four or more changes for the drill instead of two.

A corn harvester has been patented by Mr. Edward W. Comegys, of Edesville, Md. Saw toothed blades are hung on arms near the ground, and extend back diagonally to the line of travel to cut off the stumps of corn stalks near the ground, and so that a person on the machine can control the cutting and gathering into bundles of the corn and stalks of two rows while passing once between them.

MISCELLANEOUS INVENTIONS.

A button fastener has been patented by Mr. Charles F. Harlan, of Ottumwa, Iowa. It is formed of a single piece of wire, with an eye to receive the eye of the button, while the form is such that eye or other buttons may be attached thereby to a garment without stitching.

A stem winding watch has been patented by Mr. Leo Aeby, of Madretsch, near Bienne, Switzerland. This invention covers a novel construction for simplifying the manufacture of such watches, by dispensing with the bridge, a nut and screws, and giving some other parts double functions.

A medical compound as a remedy for rheumatism has been patented by Mr. John R. Barr, of Union Star, Ky. It consists of apple brandy, star root, gum guaiacum, nitrate of potash, and prickly ash berries, compounded in certain proportions and used as stated.

An organ action has been patented by Mr. Jarvis Peloubet, of Bloomfield, N. J. The invention consists, in connection with the reed chambers, of valves and a rod for actuating them, and movable in line with its length, the arrangement being such that the reeds can be easily withdrawn for tuning.

A metal eyelet or button hole has been patented by Mr. Thomas B. Ashford, of Clinton, N. C. It is formed of a hollow disk and a face plate, between which is arranged a spring catch of peculiar construction to lock under the button head, the device being especially applicable for leather carriage curtains, to counteract the effects of wear and shrinkage.

A folding barrow truck has been patented by Mr. Joseph W. Coleman, of Schooley's Mountain, N. J. It is so made that the side bars may be folded together, and that movable bottom and side pieces may be added, to make a wheel barrow, or for use as a baggage truck, which can be folded in very small space.

An exercising chair has been patented by Mr. Joseph M. W. Kitchen, of New York city. The seat and pedestal are connected by two shafts, two pairs of standards and their rollers, slotted bars to receive the rollers, and operating handles to give an up and down movement to the chair seat, there being springs interposed to equalize the motion.

A hame fastener has been patented by Mr. Henry R. Robinson, of Golden, Col. It consists of a bar plate, a hook plate, and a locking and releasing lever, of novel construction, particularly adapted to secure the lower ends of hames to the collar of a draught animal, but applicable as a saddle girth fastener, or for other analogous uses.

A method of working button holes has been patented by Mr. Sherwood B. Ferris, of Lakewood, N. J. It consists in arranging a series of detached pieces of fabric at suitable distances apart to form the sides of the button holes, and uniting such pieces by a binder stitched to hold them in their spaced positions, and to close each button hole at the ends.

An adjustable panel snow fence has been patented by Mr. Rollin H. Gleason, of Egan, Dakota Ter. The panel is erected at the top of a cut, so that when the wind blows toward the cut it strikes a vane bringing the panel into such position that the wind will clear the snow out of the cut, the device working automatically.

A clothes drier has been patented by Mr. Benjamin F. Buxton, of Brookfield, Vt. Combined with standards is a vertically sliding plate, with arms pivoted thereto and bars pivoted to the arms, clothes being placed on the bars when the plate is lowered, when the plate is raised by a rope and pulley, and locked in position by fastening the rope to a cleat.

A ratchet drill has been patented by Mr. Isaac D. Weaver, of Lebanon, Pa. It has a stop, with different angles, so arranged that the stop may be adjusted to project in opposite directions from the casing in order to engage the work, and prevent the casing from revolving, the angular socket permitting each point to be placed therein in a variety of ways.

A folding dish drainer has been patented by Mr. Fred Eaton, of Conway, N. H. It is formed of two pairs of crossed standards united at the intersections and at the outer ends, with wires extending from the rods connecting the outer ends of the standards with the rod uniting the same at the intersections, to hold dishes upright to drain off the water, and folded compactly when not in use.

A rope reel has been patented by Messrs. William M. Kizer and Charles W. Clink, of Winfield, Mich, It has connected end frames with radial slots, rotatable disks mounted next the end frames with cam or eccentric slots, and cross rods entering the radial and eccentric slots, so that upon turning the disks the rods may be expanded to tighten within the coil of ropes.

A regenerative gas burner has been patented by Mr. Eilert O. Schartau, of Philadelphia, Pa. It has a hood above the top of the chimney to concentrate the heated air and products of combustion in a trumpet mouthed tube, causing a screw to revolve and draw in a current with the blaze, making an intense heat, expanding the gas, and promoting thorough combustion, with other novel features.

A cloth guide for fulling mills has been patented by Mr. Thomas Kitson, of Stroudsburg, Pa. It is made of glass or porcelain, whereby wear and friction are reduced, and the guide presents rounded surfaces exposed to the cloth, being inserted within the usual perforated guiding face, whereby the guide is protected from injury, and may be readily detached and replaced.

A whiffletree coupling has been patented by Messrs. Frank D. Warner and William J. Matthews, of Collinsville, Ill. Combined with the double tree and single tree are a staple, half staple, and clip with a quarter twist, it being designed that thereby the single trees will be supported in the same horizontal plane with the double tree, even when the draught strain is removed.

A sash holder has been patented by Mr. Albert Ayers, of Rahway, N. J. Combined with a socket and a plug held outward by a spiral spring is a screw designed to prevent the inner end of the plug from being pushed from the socket when the sashes are taken out of the casings, the device being adapted for car, carriage, or house windows, to prevent rattling of the sash.

A deodorizing and disinfecting apparatus has been patented by Mr. William A. Hawkins, of New York city. It consists principally of a measuring device connected with two tanks in which are placed water and undiluted deodorizing material, the latter to be diluted with water in the measuring device preparatory to being used in the receptacle to be deodorized or disinfected.

A writing machine for the blind has been patented by Mr. William H. Perkins, of Owensborough, Ky. This invention provides a machine for writing more rapidly in embossed characters, by puncturing sheets of paper, than can be done with the usual hand slate and stiletto, and so that the embossed characters will be formed in the order in which they are read, in accordance with the code of characters.

A ladder and fruit conveyer has been patented by Mr. George W. Moore, of Dunedin, Fla. The conveyer is attached to the ladder, and consists of a box with alternate inclines and openings in its front, through which the fruit is passed, and an inclined apron near the bottom, so that the fruit can be conveyed without injury to the ground from any part of the ladder.

A flooring board has been patented by Mr. John R. Baldwin, of Montgomery, Ala. It has both its under and upper side dressed, so that shrinkage will be equal on both sides, and has longitudinal concave shaped recesses in its under side of approximately the same area as the area of its upper side, making air spaces which assist in preventing dry rot, and lightening the weight.

A dial for time pieces has been patented by Mr. Henry W. Oliver, of New York city. It is a compound dial having a main inner stationary dial with one set of numerals, and a forwardly and backwardly turning outer dial, one dial indicating one-half of the day and the other the other half of the day by means of certain automatic attachments, to indicate standard time in clocks and watches.

NEW BOOKS AND PUBLICATIONS.

MOULDER'S TEXT BOOK. By Thomas D. West. New York: John Wiley & Sons.

This work, though an independent volume of 450 pages, forms part ii. of "American Foundry Practice," by the same author, who is a practical iron moulder and foundry foreman. It presents original methods and rules for obtaining sound, clean castings, and gives detailed descriptions for making those more difficult moulds which call for the best skill and experience. The book also presents some practical considerations on the construction and operation of cupolas, and the melting of iron and scrap steel in foundries, with forty-six reports of cupola workings in different States, giving the experience of founders in mixing and melting iron, and the comparative economy of various methods of working cupolas.

A TEXT BOOK OF THE MATERIALS OF CONSTRUCTION. By Robert H. Thurston. New York: John Wiley & Sons.

This volume of 700 pages is an abridgment of the author's former work in three volumes on the "Materials of Engineering," and is intended more particularly for use in technical and engineering schools, the author having used a good portion of the work here given in the instruction of classes in mechanical engineering.

THE PAPER MAKERS' DIRECTORY OF ALL NATIONS. By S. Charles Phillips. London: The *Paper Makers' Circular*.

The list of paper makers in the world forms a handsome volume, the United States heading the list with 1,122 mills, after which come Germany with 1,037, France 512, Austro-Hungary 378, England and Wales 287, Italy 194, Russia 148. The total of the mills in the world is 4,296.

STORIES OF INVENTION, TOLD BY INVENTORS AND THEIR FRIENDS. By Edward E. Hale. Boston: Roberts Bros. 1885.

In his preface, Mr. Hale recalls the legend of the old Public Library at Dorchester, which was only opened on Saturday, and where the usual message brought by the little people to the perplexed librarian was that "Mother wants a sermon book and another book." To decide what this "other book" shall be is largely the purpose of the series of which the present volume is the fifth and concluding number. It is a series intended to give young people hints about their reading. These suggestions come very pleasantly from the lips of their old friend Mr: Frederick Ingham, or Uncle Fritz as he is commonly called, whose various travels and adventures are pretty thoroughly known to old and young people all over the land. The club of five and twenty nieces and nephews who gather around Uncle Fritz at Lady Oliver's house, near Boston, have been instructed according to Emerson's rule, "Read in the line of your genius," and have, in deference to the varied talents of their members, considered successively the tales of soldiers, of sailors, of adventurers, of discoverers, until now they meet to read up the lives of inventors. With the aid of the chief in the arm chair, they make out a number of very interesting stories, from Archimedes and the earlier inventors down to Bessemer and Goodyear. They are all attractively told, and will stimulate young people to investigate for themselves the wealth of information stored up in our libraries.

NATURE'S TEACHINGS. Human Invention anticipated by Nature. By the Rev. J. G. Wood, M.A., F.L.S. Boston: Roberts Bros. 1885. Illustrated.

In this volume of analogies, the author has attempted to show that there is scarcely a single invention of man which has not its prototype in nature, and that the largest results have sprung from apparently the most insignificant means. He traces the origin of our common tools and implements in navigation, war and hunting, architecture, optics, acoustics, and the useful arts generally, to some model in either the vegetable or animal world; and as the moral to his tale, points to the same sources for the inspiration for further achievements. It is a book which shows ingenuity, and is interesting from the glimpses of natural history which it affords.

FOWNES' MANUAL OF CHEMISTRY. A New American from the Twelfth English Edition. Embodying Watts' "Physical and Inorganic" Chemistry. Philadelphia: Lea Brothers & Co.

Professor Fownes' work has long been a standard, and, although there are now more elaborate treatises on every branch of the subject, Fownes' Manual continues to be among the most popular of all books on chemistry. It has been many times re-edited, since the death of the author in 1849, as was absolutely necessary from the changes in chemical nomenclature and the advances in our knowledge of chemistry; but it still maintains the character of an excellent elementary treatise, while being very comprehensive in its scope. With the present edition is also incorporated Dr. Watts' admirable revision, almost amounting to an entirely new work, of the portion on Physical and Inorganic Chemistry. This part of the work fills about one-half of the 1,050 pages in the volume, and affords an excellent introduction to the study of chemistry in 100 pages on physics, followed by the chemistry of the elementary bodies and the chemistry of the metals. The book has an excellent index, and is published at a comparatively low price.

PARIS IN OLD AND PRESENT TIMES. By Philip Gilbert Hamerton, Officier d'Academie. Boston: Roberts Bros. 1885.

To those who are already acquainted with Mr. Hamerton's writings, and particularly with "The Intellectual Life" or some of his art critiques, it will be quite unnecessary to recommend the present volume, for they will take it for granted that the book cannot be other than interesting. His point of view is habitually unique, for both education and circumstances have made him a spectator rather than an actor in the events of every day life. There is consequently something about his writings which always breathes of a certain intellectual abstraction, though it is never carried so far as to become distasteful. In his treatment of even so apparently a material subject as the topography of Paris, this characteristic is everywhere visible. The account which he here gives us of a city whose history has always been full of cosmopolitan interest, from the days of Julian the Apostate to our own, throws an additional charm over her historic chateaux and modern boulevards. Mr. Hamerton is well qualified to write of Paris, for he has known the city intimately for twenty-seven years, and he has been so fortunate as to cover entirely new ground. He sketches the appearance of the city as it was, when the island of Lutetia carried the Roman nucleus of the modern city, and down to the time when a succession of ambitious princes and an energetic republic have made it of all capitals the most beautiful. The illustrations of the book are well chosen, though the details of some of them are almost too shadowy.

Received.

REPORT OF THE FIRE DEPARTMENT OF THE CITY OF NEW YORK. Giving details of Force and Equipment, and Fires of 1884. By the Commissioners.

NOTES ON THE CHEMISTRY OF IRON. By Magnus Troilius. New York: John Wiley & Sons.

THE WOODS OF THE UNITED STATES: with an Account of their Structure, Qualities, and Uses. By C. S. Sargent. New York: D. Appleton & Co.

THE NAUTICAL ALMANAC AND TIME TABLES, 1886. An Abridgment, with list of United States Lighthouses. New York: John Bliss & Co.

HEADS AND FACES, AND HOW TO STUDY THEM. By Nelson Sizer and H. S. Drayton. New York: Fowler & Wells Co.

THE PHYSICIAN'S VISITING LIST FOR 1886. A Convenient Pocket Book. Philadelphia: P. Blakiston, Son & Co.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Pattern Letters (metallic) to put on patterns of castings. H. W. Knight, Seneca Falls, N. Y.

Gardner & Miller's Patent Belt Clamps, 8 sizes. Billings & Spencer Co., Hartford, Conn.

Applegate (burglar) Invis. Elct. Matting. 1512 Chest., Phila.

Curtis Pressure Regulator for Steam Heating Apparatus, Waterworks, etc. Curtis Regulator Works, Boston, Mass.

Estimates given and contracts taken for the construction of intricate mechanical instruments, fine tools, models, and light machinery. Burckhardt & Schneider, 211 Mulberry Street, Newark, N. J.

Wanted.—Patented articles to manufacture and introduce. Address "B," Box 88, Newark, N. J.

Wanted.—A second-hand Hammond Type Writer; must be in perfect working order and of latest and most improved make. Must be cheap. Address J. M. H., P. O. box 773, New York.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, polishing compositions, etc. $100 "*Little Wonder.*" A perfect Electro Plating Machine. Sole manufacturers of the new Dip Lacquer Kristaline. Complete outfit for plating, etc. Hanson, Van Winkle & Co., Newark, N. J., and 92 and 94 Liberty, St., New York.

Grimshaw.—Steam Engine Catechism. A series of thoroughly Practical Questions and Answers arranged so as to give to a Young Engineer just the information required to fit him for properly running an engine. By Robert Grimshaw. 18mo, cloth, $1.00. For sale by Munn & Co., 361 Broadway, N. Y.

The Knowles Steam Pump Works, 44 Washington St., Boston, and 93 Liberty St., New York, have just issued a new catalogue, in which are many new and improved forms of Pumping Machinery of the single and duplex, steam and power type. This catalogue will be mailed free of charge on application.

Coiled Wire Belting takes place of all round belting. Cheap; durable. C. W. Belting Co., 93 Cliff St., N. Y.

Air Compressors, Rock Drills. J. Clayton, 43 Dey st., N. Y.

Haswell's Engineer's Pocket-Book. By Charles H. Haswell, Civil, Marine, and Mechanical Engineer. Giving Tables, Rules, and Formulas pertaining to Mechanics, Mathematics, and Physics, Architecture, Masonry, Steam Vessels, Mills, Limes, Mortars, Cements, etc. 900 pages, leather, pocket-book form, $4.00. For sale by Munn & Co., 361 Broadway, New York.

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Send for catalogue of Scientific Books for sale by Munn & Co., 361 Broadway, N. Y. Free on application.

Walrus Leather for polishing. A choice invoice English tanned just arrived. Greene, Tweed & Co., N. Y.

Shafting, Couplings, Hangers, Pulleys. Edison Shafting Mfg. Co., 86 Goerck St., N. Y. Send for catalogue and prices.

Iron Planer, Lathe, Drill, and other machine tools of modern design. New Haven Mfg. Co., New Haven, Conn.

Wanted.—Patented articles or machinery to manufacture and introduce. Lexington Mfg. Co., Lexington, Ky.

For Power & Economy, Alcott's Turbine, Mt. Holly, N. J.

Send for Monthly Machinery List
to the George Place Machinery Company,
121 Chambers and 103 Reade Streets, New York.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40. Various other foreign patents may also be obtained. For instructions address Munn & Co., SCIENTIFIC AMERICAN patent agency, 361 Broadway, New York.

Machinery for Light Manufacturing, on hand and built to order. E. E. Garvin & Co., 139 Center St., N. Y.

Supplement Catalogue.—Persons in pursuit of information of any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

Send for descriptive circular on lubrication. Charles H. Besly & Co., North American Agents for Reisert's Celebrated Solid Oil, 175 & 177 Lake St., Chicago, Ill.

Curtis Pressure Regulator and Steam Trap. See p. 222.

Keystone Steam Driller for all kinds of artesian wells. Keystone Driller Co., Limited, Box 32, Fallston, Pa.

Bradley's improved Cushioned Helve Hammer. New design. Sizes from 25 to 500 lb. Bradley & Co., Syracuse, N. Y.

Chucks—over 100 different kinds and sizes in stock. Specials made to order. Cushman Chuck Co., Hartford, Ct.

Cyclone Steam Flue Cleaners are the best. Crescent Mfg. Co., Cleveland, O.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Friction Clutch Pulleys. D. Frisbie & Co., Phila.

Tight and Slack Barrel Machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv., p. 286.

Blake's Belt Studs. The strongest and best fastening for Rubber and Leather Belts. Greene, Tweed & Co., N. Y.

Magic Lanterns and Stereopticons of all kinds and prices. Views illustrating every subject for public exhibitions, Sunday schools, colleges, and home entertainment. 136 page illustrated catalogue free. McAllister, Manufacturing Optician, 49 Nassau St., New York.

The "Improved Green Engine," Automatic Cut-off. Providence Steam Engine Co., R. I., *Sole Builders.*

Manufacture of Soaps, Candles, Lubricants, and Glycerine. Illustrated. Price, $4.00. E. & F. N. Spon, New York.

"*To Mechanics.*"—When needing Twist Drills, ask for "*Standard*," or send for catalogue to Standard Tool Co., Cleveland, O. See page xi., Export Edition.

Steel name stamps, 15 cts. per letter; steel figures, $1 per set. F. A. Sackmann, 1099 First Ave., Cleveland, O.

Seam and Looping Machines, patent Burr Wheels, Brushing Machines. Tubbs & Humphreys, Cohoes, N. Y.

Iron and Steel Wire, Wire Rope, Wire Rope Tramways. Trenton Iron Company, Trenton, N. J.

Pattern and Brand Letters, Steel Punch Letters. Vanderburgh, Welis & Co., 110 Fulton St., New York.

Wood Working Machinery. Full line. Williamsport Machine Co., "Limited," 110 W. 3d St., Williamsport, Pa.

Astronomical Telescopes, from 6" to largest size. Observatory Domes, all sizes. Warner & Swasey, Cleveland, O.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Information requests on matters of personal rather than general interest, and requests for **Prompt Answers by Letter,** should be accompanied with remittance of $1 to $5, according to the subject, as we cannot be expected to perform such service without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Minerals sent for examination should be distinctly marked or labeled.

(1) H. E. P. writes: I have a Leclanche battery of 8 cells, disk form, which has never worked more than 10 minutes at a time. No cleaning will improve it, as the cups are clean inside as well as outside. I think they are not properly filled. Will you please give in the next number of SCIENTIFIC AMERICAN the proportions of the contents of the cups? A. Soak the cells of your Leclanche battery in warm water for several hours. Clean the zinc thoroughly, and refill the porous cells with equal parts of granulated black oxide of manganese and granulated carbon. After filling, seal the top of each porous cell around the carbon rod with pitch, leaving a small aperture for the escape of gas. The Leclanche battery is not adapted to continuous use; a half hour on a close circuit is too long a time for this battery.

(2) J. R. writes: I want to make a small Gramme machine, armature about six or eight inches long. Have you a description of any other construction? A. For a small dynamo, you will find the Siemens machine, described in SUPPLEMENT, No. 161, the best and simplest. It is quite difficult to make a very small Gramme machine.

(3) F. W. T. asks (1) whether flat Norway iron will do in the place of horseshoe magnets in making a small telephone, and will it work without a battery? A. Norway iron will not take the place of the horseshoe magnet, because the permanent magnetism of the horseshoe magnet is necessary to the working of the telephone. 2. Are there any back numbers of the SCIENTIFIC AMERICAN or SUPPLEMENT containing a description of how to make a small telephone that will work for a distance of about half a mile, to work with a battery? If so, what numbers, and what will they cost? A. See SUPPLEMENT, No. 149. 3. What is used in making a telephone battery? A. The battery commonly used in connection with the telephone is that known as the Leclanche battery. See SUPPLEMENT, Nos. 157, 158, and 159.

(4) S. F. E. writes: Please tell us through the SCIENTIFIC AMERICAN the best telephone for us country folks to use, one that we can buy outright and will be durable? A. For short distances, the acoustic telephone answers very well, and is largely used. See our advertising columns for addresses of makers of acoustic telephones. We do not know of any electric telephones that are on sale.

(5) H. S. sends a specimen of a plant for identification. A. The specimen came in altogether too fragmentary a state to make anything out of it. Send us the leaves and flowers carefully pressed, and inclosed between pieces of cardboard, and we will name the plant for you.

(6) J. B.—There is a difference of opinion among mechanical engineers as to the most perfect forms of action of link motion valve gear. There is considerable variation in forms and arrangements among the engineers of England, Germany, France, and the United States, all claiming perfection in their way. We think you will do well to make a thorough study of the work of others as a set off to your own ideas. We recommend: "Link Motion," by Auchincloss, $3.00; "Treatise on Valve Gears," Zeuner, $5.00; "Link Motion," by Burgh, $12.00; which may be had from this office.

(7) G. A. S. asks: How can I tell the temper of a razor when buying same, and also the hardness of the steel? A. Only by actual trial, if you are unwilling to take the guarantee of the manufacturer or dealer.

(8) E. R. asks: 1. Can brass be worked in a drop at all? That is, can it be drop forged, same as iron can? A. Soft brass can be worked very well in a drop press, but not to same extent as hot iron or steel. 2. I was told yesterday by one of your clients that he saw a perpetual motion machine in operation in New York, last spring or early summer, and that the machine would run until worn out unless stopped. Was such a machine exhibited? A. We know nothing of the perpetual motion machine referred to. We do not think a genuine perpetual motion machine has ever been on exhibition in this city.

(9) E. N. P. writes: 1. I have a large quantity of No. 16 cotton covered and No. 36 silk covered copper wire; can I use this in constructing a hand power electrical machine, as described in SUPPLEMENT, No. 161? A. You can use your No. 16 wire to very good advantage in the electric machine referred to, but the No. 36 is too fine. 2. A cheap battery for induction coil described in SUPPLEMENT, No. 160? A. Grenet's battery, or the plunging bichromate battery, described in SUPPLEMENT, Nos. 157, 158, and 159, will answer your purpose. 3. What alterations must be made in the electric machine to use it as a motor? Also, how many cells of battery, and what kind? A. Use less wire on the field magnet, and wind the armature with coarser wire, say No. 16. 4. Can the electric machine be used for nickel or silver plating? If so, what changes must be made? A. It can be used for plating without any change.

(10) M. M. M. writes: I have made a clay contour map. I should like to know of some material with which I can coat it, rubber, papier mache, or something of the sort, with which I can take an impression without first making a female cast in plaster. I want only one impression. A. We think that very thin sheets of gutta percha softened by immersion in warm water will answer your purpose.

(11) R. N. asks: Can you explain why 18 karat gold, being alloyed with silver and copper equal parts, cannot be beaten out into a thin leaf, when each of the above metals can be separately, and the best way of solving the question? A. The behavior of alloys can never be predicted by an examination of the separate metals. An alloy of silver and copper with gold is harder and more brittle than finer gold, therefore cannot be as readily beaten out into leaf.

(12) J. M. A. writes: I wish to put up a short telephone line, using an acoustic (advertised in SCIENTIFIC AMERICAN), and want to know if uncovered copper wire will answer the purpose as well as covered? If not, why not? Does the use of batteries improve the working of such lines, or do they only operate call bells? A. If your wire is well supported by insulators, the uncovered wire will answer a very good purpose. The batteries used in connection with this telephone, we believe, are merely for operating the call bells.

(13) J. C. O'D. asks: If I use two siphons, each having a two inch bore, to empty a large vessel, and allow the discharge end of both to be at the same level, but the elbow of one is 2 feet above surface of water and of the other 20 feet above water surface, from which pipe will most water flow, and from which will it fall with greatest force? A. From the shorter pipe. The friction of the longer pipe will retard the flow of water.

(14) L. D. B. writes: 1. I made an electric motor on the principle of the revolving turntable for store windows; the cores are five-sixteenths diameter wound with 6 layers of No. 16 wire; it works very well. Wishing to make a more powerful motor, I took nine-sixteenths inch iron, wound them with 8 layers No. 24 wire, and used 6 armatures fastened parallel to the shaft in the style of a water wheel. This machine does not equal the first either in speed or power when I use the same battery on each, which is a carbon battery with electropoion fluid in the porous cup. Is it due to the fine wire that it does not work as it should? A. Your difficulty is due to the resistance of the fine wire with which your magnet is wound. If you had wound your larger magnet with the No. 16 wire, you would have succeeded better. 2. What is the limit to the number of armatures that can be used with one magnet? A. We do not know that there is any limit, but we think there is no advantage in a large number of armatures, when used in connection with a single magnet. 3. Will not an intensity battery work much better on a magnet wound with coarse wire than a quantity battery on a magnet with fine wire? A. Yes; but it would be best in all cases to adapt the battery and the magnet to each other. 4. Is there any other way to obtain the speed of small motors when a pencil tied to the shaft with a piece of paper drawn over it reduces the speed, even when making an almost imperceptible mark? A. You can do it by allowing the armature to act as an interrupter to a jet of air. The motor will then act as a siren. The tone produced may be compared with that of a musical instrument; and as the rate of vibration required to produce such a tone is known, you can readily decide as to the velocity of your motor. 5. What is India ink made of, and why has it such an abominable smell after standing mixed for some time? A. India ink is made of extremely fine lamp black and a gum. The smell to which you refer is due to the putrefaction of the gum.

(15) P. E. writes: 1. After dissolving one gramme of rock phosphate in half an ounce of HCl to keep the iron and alumina in solution, I add citric acid in crystals, but I get a precipitate, which I think ought not to be. What can be the cause? A. We think that the precipitate will be avoided if you use, for every two grammes of the rock, 2½ grammes oxalic acid and 4 grammes citric acid dissolved in 10 c. c. of acetic acid, instead of the crystallized citric acid. 2. Then I have to neutralize the solution with ammonia until a faint precipitate appears, and have to redissolve the precipitate with a small quantity of HCl, and have to add oxalic acid to precipitate all the lime present. What is the quantity of oxalic acid I must make the solution of to add to the precipitate; make alkaline with ammonia, and allow to stand for 12 hours? A. A concentrated solution, almost up to saturation, can be used. 3. To the filtrate, which I have to make strongly alkaline with ammonia, I must add a quantity of chloride of ammonia to prevent any magnesia being precipitated, and then I have to add magnesia mixture, to precipitate all the phosphoric acid. A solution containing how much chloride of ammonia must I use, and how many c. c. of the magnesia mixture? A. The quantity of ammonium chloride required depends upon the strength of your magnesia mixture. It is best to use a standard magnesia mixture solution, from which you can readily calculate the proper amount of the ammonium salt necessary. The quantity of phosphoric acid contained in your rock determines the amount of magnesia mixture required; 45 grammes of the crystallized sodium acetate. Teschemacher and Smith published in London, a few years ago, a little book on the proper methods to be used in analyzing phosphate rock, which would doubtless be valuable to you.

(16) J. E. W. asks: Will quicksilver, if thrown in a canal or pond, work its way through the bank or dam, and thereby cause a leakage and break? A. Quicksilver tends to penetrate porous substances only by its weight or gravity. It does not wet or attach itself to the surface of the particles of sand as water does, and hence has not capillary attraction to help draw it through a porous substance. This we think partially counteracts its superior gravity, and will make it no more liable to filter through a canal bank than the water itself; certainly not to the extent of displacing the material or facilitating the flow of water.

(17) T. J. B. writes (1) for a recipe for preparing a good glue to use with pine wood. A. Use an ordinary glue to which a little glycerine has been added. It is best to use the glue while hot. 2. A recipe for preparing a walnut and mahogany stain? A. To stain black walnut: Take 1 quart water, 1½ ounces washing soda, 2½ ounces Vandyke brown, ¼ ounce bichromate of potash. Boil for ten minutes, and apply either in a hot or cold state. For mahogany: Boil ½ pound madder and 2 ounces logwood chips in a gallon of water; brush well over the wood while hot; when dry, go over the whole with pearlash solution, 2 drachms to the quart. 3. What kind of varnish to use after such furniture is stained? A. A good mahogany varnish consists of sorted gum anime 8 pounds, clarified oil 3 gallons, litharge and pure dried sugar of lead each ¼ pound; boil till it strings well, then cool a little, thin with oil of turpentine, 5½ gallons, and strain.

(18) W. G. J. asks for any mechanical method whereby the air can be taken out of water. A. You can free the water from air by boiling, or by a vacuum pump. With your unlimited water power, you may set the freezing cans or boxes filled with water into a chamber capable of withstanding a vacuum pressure, and then pump the air from the chamber, when the air will also leave the water. A chamber made so that a half dozen water cans would just fill it could be so arranged as to complete the operation every half hour, and in this way, with 2 or 3 chambers, make many tons of water airless per day. If the freezing cans could be made strong enough, no chamber would be necessary, only caps with rubber rings with a pipe leading to the air pump.

(19) R. H. E. K. asks the best mode of cleaning the grooves of a Smith & Wesson No. 3 United States Army revolver, without risking blunting sharp edges. A. Make a little scraper out of stiff iron wire by screwing the wire in a vise and hammering the end over the edge of the vise jaw, then file to fit the pistol groove. Take the barrel out of the stock, and hold up to the light, when you can see to scrape out the grooves. If they are badly leaded, you may have to make a chisel shaped scraper, with which you can plow out the grooves.

(20) W. W. C.—A hot cannon ball cools from the outside. If cooled in water, the surface may be black while the center is red hot. A cannon ball or any ironwork will sink to the bottom of the ocean as fast as gravity will carry it through the water. No matter how great the pressure is at great depths from the superincumbent mass of water, the specific gravity of the water is but little greater than at the surface. Hence all substances as stone, sand, mud, clay, shells, etc., exist at great depths with but little variation, except from the effects of decreased light.

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November 3, 1885,

AND EACH BEARING THAT DATE.

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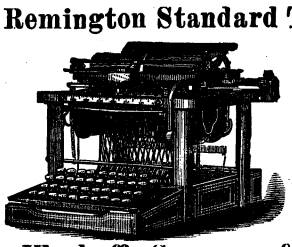

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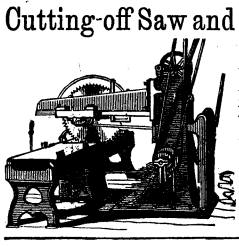

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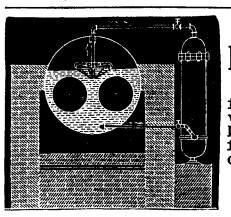

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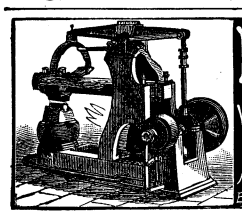

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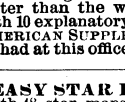

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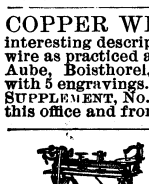

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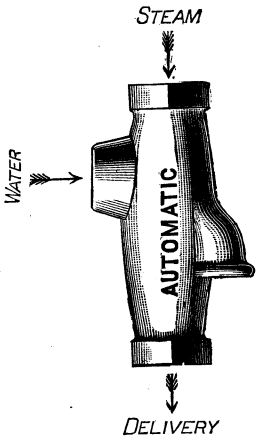

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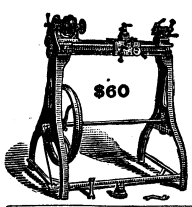

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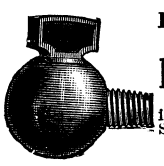

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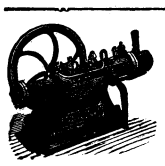

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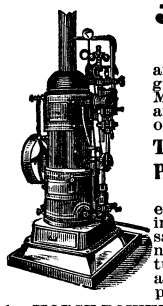

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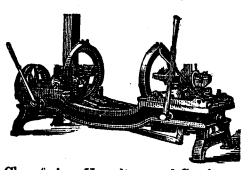

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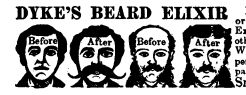

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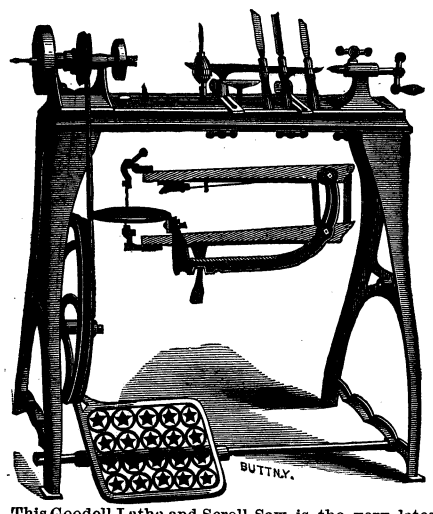

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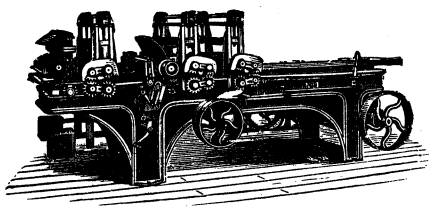

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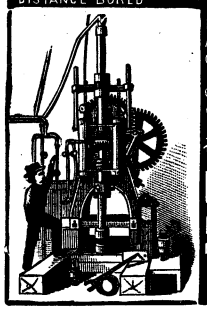

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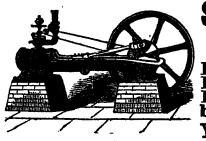

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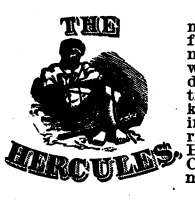

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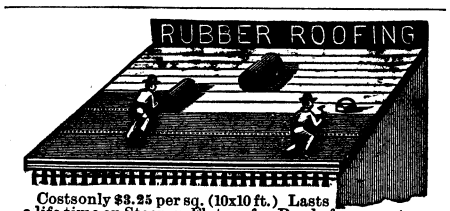

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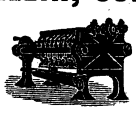

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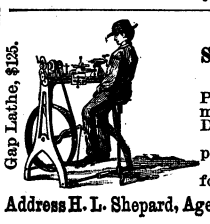

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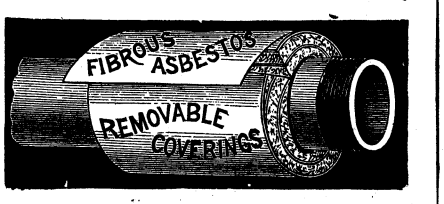

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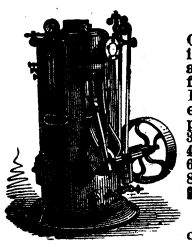

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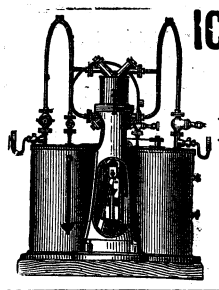

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